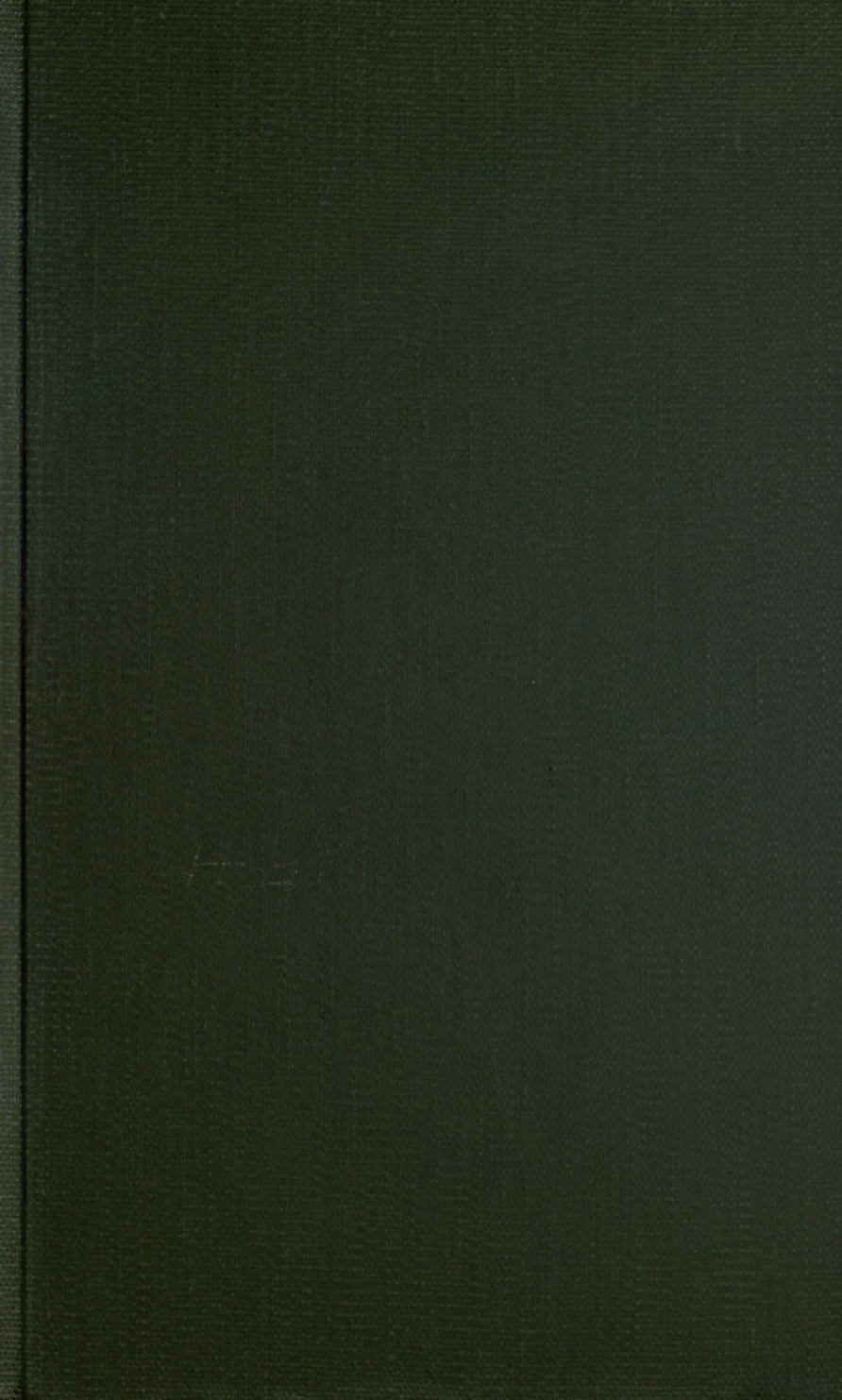








AUSTRALIAN MUSEUM, SYDNEY.

MEMOIR III.

THE

ATOLL OF FUNAFUTI,

ELLICE GROUP:

ITS ZOOLOGY, BOTANY, ETHNOLOGY, AND
GENERAL STRUCTURE

BASED ON COLLECTIONS MADE BY

MR. CHARLES HEDLEY,

OF THE

AUSTRALIAN MUSEUM,

SYDNEY, N.S.W.

PUBLISHED BY ORDER OF THE TRUSTEES.

R. ETHERIDGE, Junr., Curator.

SYDNEY, 1896-97.

ITALIAN MUSEUM, SYDNEY

MEMORANDUM

RECEIVED 1922-23

INTRODUCTORY NOTE.

THE Local Committee of the "Funafuti Coral Reef Boring Expedition, of the Royal Society" (London), in charge of Prof. Sollas, LL.D., F.R.S., having suggested to the Trustees of the Australian Museum that one of their Officers should be deputed to accompany the Expedition, Mr. Charles Hedley was selected for the purpose.

Mr. Hedley left Sydney in H.M.S. "Penguin," under the command of Capt. Mervyn Field, R.N., on May 1st, arriving at Funafuti on May 21st. He remained on the island for two and a half months, leaving in the same vessel. On the return voyage to Fiji, the Island of Nukulailai was touched at, where scientific investigations were renewed for two days. Mr. Hedley finally reached Sydney on August 22nd.

During his stay on Funafuti, Mr. Hedley succeeded in amassing an interesting collection, particularly of Invertebrate and Ethnological objects, together with much valuable scientific information. The collections are now in process of description by the Scientific Staff of the Museum, and the results are being published in the order in which the study of the various groups is completed.

A brief account of the results of the boring operations at Funafuti, extracted from Prof. Sollas' letters, will be found in "Nature" of 24th Sept., 1896, p. 517.

R. ETHERIDGE, Junr.,
Curator.

Sydney, 21st December, 1896.

AUSTRALIAN MUSEUM, SYDNEY.

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CORRECTIONS.

- Page iii., paragraph 2, line 2—for "Mervyn" read "Mostyn."
- „ 9, „ 4, line 1—for "Mervyn" read "Mostyn."
- „ 20, foot-note § —for "1844" read "1884, p. —."
- „ 71, paragraph 3, line 4—for "supplied" read "applied."
- „ 97, line 6 —for "Nob" read "Latr."
- „ 98, line 17 —for "Nob" read "Macq."
- „ 155, heading, above Echinodermata, read "[VII.]"
- „ 220, line 34 —for "VIRIDE" read "VIRIDIS."
- „ 231, line 2 —for "genealogies" read "genealogies."
- „ 250, foot-note § —for "ix." read "xi."
- „ 276, foot-note † —for "1897" read "1887."
- „ 301, foot-note * —for "1876" read "1878."
- „ 389, paragraph 3, line 1—add after fig. 2, "and Plate xxvii., fig. 1."
- „ 389, „ 4, line 3—for "fig. 6" read "fig. 2."
- „ 389, „ 4, line 7—for "fig. 7" read "fig. 1."
- „ 390, „ 3, line 2—for "fig. 8" read "Plate xxvii., fig. 2."
- „ 390, „ 3, line 10—delete "fig. 8."
- „ 392, „ 2, line 4—for "perceptable" read "perceptible."
- „ 398, „ 2, line 4—for "indicate" read "indicates."
- „ 398, „ 4, line 4—for "have" read "has."
- „ 399, „ 4, line 8—for "reject" read "rejects."
- „ 528, line 16 —for "david" read "davidis."
- „ 530, line 38 —for "Chiridota" read "Chirodota."

CATALOGUE SLIPS.

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1 vol. 8vo., Sydney, 1896–1900.

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GENERAL ACCOUNT
OF THE
ATOLL OF FUNAFUTI

By C. HEDLEY,
Conchologist to the Australian Museum.

[I.]
GENERAL ACCOUNT
OF THE
ATOLL OF FUNAFUTI

By C. HEDLEY, Conchologist to the Australian Museum.

THE ARCHIPELAGO.

THE Ellice Group is an Archipelago of somewhat vague limits, which trends for about four hundred miles in a north-westerly and south-easterly direction, and lies between Lat. $5^{\circ} 35'$ and $11^{\circ} 20'$ South, and Long. 176° and 180° East. After a gap of a hundred and fifty miles, the same general trend is continued across the equator into the Northern Hemisphere by the Gilberts, otherwise known as the Kingsmill or Line Islands, whose physical features repeat those of the Ellice Group, though the character of their inhabitants is widely different.

This particular archipelago is indeed but a link in a huge chain of islands which extends for about 3,500 miles from the Austral Islands through the Herveys, Samoas, Ellices, and Gilberts, to the Marshalls, forming the S.W. edge of that axial trough described by Dana* as the Central Depression of the Pacific, mapped by Whitmee† as the Great Atoll Valley, and mentioned by Lapworth as "the mightiest of all the submarine buckles of the earth crust;"‡ the opposite N.E. edge of which is indicated by the answering chain of islands stretching from Hawaii to Kure. West of this Marshall-Austral chain (the "zone pacifique australe" of Sacco§), and roughly parallel both to it and to the East Australian coast, is a second series of elevations whose contour, as shown by the "Challenger's" cross sections,|| is that of waves directed westward. These latter elevations have in common a fauna and flora characteristically continental, in contrast to the essentially drift fauna and flora of the outer chain, from which they are also distinguished by a system of volcanoes. The term Melanesian Plateau has been proposed¶ as a collective geographical name for these elevations,—whose summits, now projecting as dry land, are New Zealand, Lord Howe Island, New

* Dana—Corals and Coral Islands, 1872, p. 328.

† Encyc. Britt., (9) xix., 1885, Pl. iii.

‡ Rep. Brit. Assoc. for 1892 (1893), p. 705.

§ Sacco—Essai sur l'Orogenie de la Terre, Turin, 1895, p. 31.

|| Challenger Reports—Deep Sea Deposits, 1891, Diagrams, 11, 12, 13.

¶ Hedley—Proc. Linn. Soc. N.S.W. (2), vii., 1892 (1893), p. 335.

Caledonia, New Hebrides, Fiji and the Solomons,—which during the life of the existing fauna have been first deeply sunk and then slightly elevated. Viewing Australia as the massif around which have been concentrically heaped up* this inner and outer chain, it is noteworthy that the only point in which the outer chain has swelled into large and lofty islands is where, in the Samoan Archipelago, it has swept on to the heel of the Melanesian Plateau.

Proceeding southwards the following are the inhabited islands of the Ellice:—Nanomea, Niutao, Nanomana, Nui, Vaitapu, Nukufetau, Funafuti, Nukulailai, and Nurakita. Every member of the group is essentially an atoll or lagoon island, but in the smallest, like Nurakita, the structure is masked by the filling in of the lagoon having reached completion, and converted the interior of the atoll from water to land.

To elucidate the relation of Funafuti to the other members of the group, the following sketch of the archipelago is compiled from the notes of various travellers:—

NURAKITA.—“Six hundred miles from Samoa, sailing north-westerly, the first of the group, Sophia Island, is sighted. It is the south-easterly outlier of the group, and is the only one of sufficient height to be seen from the vessel’s deck at a distance of twenty miles. Until a few years ago it was uninhabited, although the people of the next island, Nukulaelae, say that ‘in the old, old time, many people lived there.’† It is about three miles and a half in circumference, has but few cocoanuts growing upon it, and would have remained untenanted in its loneliness to this day but for the discovery of a fairly valuable deposit of guano. Then it was taken possession of by an enterprising American store-keeper in Samoa, named Moors, who landed native labourers and worked, and is still working, the deposit. The old native name

* In this connection Messrs. Haddon, Sollas and Cole (On the Geology of Torres Straits, Trans. R. Irish Acad., xxx., 1894, p. 473) have remarked that, “As our knowledge grows, we the more distinctly see in Australia and its islands the ruins of a great southern continent, fractured and submerged, possibly during the great Alpine Himalayan revolutions, and now in process of resurgence, as the vast folds of the earth’s crust roll slowly inwards upon the central continental mass.”

† Other instances of Pacific islands once inhabited but afterwards depopulated by war, famine, disease or storm, are: Caroline Island, where the American Scientific Expedition discovered maraes, &c. (Mem. Nat. Acad. Sci., ii., 1884); Gente Hermosa, of which Whitmee says, “The island was formerly inhabited by a large race of people whose skeletons are now found, all of them I am told exceeding six feet in length. No one knows by what means they became extinct, but the fact that their skeletons are lying unburied in various parts of the island, points to famine, or an epidemic which quickly proved fatal to all the people, as the probable cause” (Missionary Cruise in the S. Pacific, 1871, p. 6); and Palmerston Island, described by Gill (Jottings from the Pacific, 1885, p. 37).

of this spot is Ulakita—a name, by the way, that is almost unknown, even to the local traders in the Ellice Group.”*

NUKULAILAI.—“Eighty or ninety miles away is Nukulaelae,† a cluster of thirteen low-lying islets, forming a perfect atoll, and enclosing with a passageless and continuous reef a lagoon five miles in length by three in width. This narrow belt of land—in no case are any of the islets over a mile in width—is densely covered with cocoanuts, and, seen from the ship, presents an enchanting appearance of the highest green, accentuated on the westerly or lee shore by beaches of the most dazzling white. Thirty years ago Nukulaelae had a population of four hundred natives. Then one day there came along two strange vessels—a barque and a brig—and hove-to close to the reef; and in a few hours nearly three hundred of the unfortunate, unsuspecting, and amiable natives were seized and taken on board by the Peruvian throat-cutters and kidnappers that had swept down upon them, and, with other companions in misery, torn from their island homes, were taken away to slavery in the guano fields of the Chincha Islands. Of the Nukulaelae people none ever returned, and all but two perished miserably under their cruel taskmasters on the gloomy Chinchas.”‡ “Fangafana is the name of the islet on which the settlement stands. Nukulaelae is the name of another islet and is used to designate the group. Near tradition traces the people to the island of Funafuti; remote mythology says that Mauke, the first man, had his origin in a stone.”§

The next atoll, FUNAFUTI or Ellice Island, is reserved for a more extended description, and passing over it we come to NUKUFETAU, or De Peyster's Group, lying sixty miles to the leeward and consisting of “A very beautiful group of thirty-seven islets almost surrounding a lagoon. The name signifies the land of the fetau (*Calophyllum inophyllum*), the only indigenous tree of large size found there. The settlement is located on the island of Te anamu, and there are houses also on Sakuru.|| Fairly good water can be obtained at Te anamu. Other islets in this group are Te afuavea, Te afuana, Te afatule, Paifa, Funata, Mata Nukulaelae (like Nukulaelae), Teafualoi, Nualei, Niuatangi, Teafuanono, Motu tu lua, Teafuniua, Niuatui, Niuatibu (a Gilbert Island name), Ouā, Lafaga (where there is said to be fresh water), Niuaruko, Faiava, Potiki, Moturaro (here also water is to be found), Motufetau, Motuloa, Te afua, Te motumua (here

* Becke—*Evening News*, Sydney, 25 April, 1896.

† Officially spelt Nukulailai, otherwise the Mitchell Group.

‡ Becke—*loc. cit.*

§ Turner—*Samoa*, 1884, p. 280.

|| “Sakuru seems to have been uplifted ten or twelve feet.”—Turner, *loc. cit.*, p. 284.

also there is water), Te afualoto, Motuloto, Te afua fale niu, Te afuatakalau, Te fale (here also there is said to be water). The names here given will, to those acquainted with Gilbert Island, Tongan, Samoan, and Rarotongan dialects, furnish instances of the influence of all these dialects in the nomenclature of the group.* In 1884 Mr. C. M. Woodford estimated the population at 240.†

VAITUPU.—“Oaitupu‡ (literally ‘the fountain of water’) is although nearly the smallest, the most thickly populated of all. It has no lagoon accessible from the sea, and landing even is not always easy. Here, although the soil is better than that of the other islands, and the natives have taro, bananas, and pumpkins to vary the monotonous diet of cocoanut and fish obtaining elsewhere in the Ellices, they are very subject to that species of eczema known as *tinea dequamans* (locally it is called ‘lafa’).”§ The Rev. S. J. Whitmee says||:—“It is nearly round, about four miles across, and has a salt water lagoon in the centre, completely shut off from the sea by a ring-like strip of land about half a mile across. The population amounting to three hundred and seventy-six are very advanced.”

The next island, NUI, Egg or Netherland Island, is remarkable for being in the possession of an outlying colony of Gilbert Islanders or “Tafitos,” differing from the Ellice Islanders in language, customs, appearance and demeanor.¶ Moresby says:—“We communicated with Egg or Netherland Island, a crescent-shaped reef, with the horns of the crescent lying about two and a half miles north and south of each other. The two hundred inhabitants were all Christians, and had escaped the kidnapper; their village stands on an islet on the southern horn.”**

NANOMANA.—“Nanomaga, the Hudson Island†† of Commodore Wilkes, is the smallest of the group. It is barely a mile and a half long, and not one in width, yet supports a population of six hundred people. The writer (who was the second white trader there since the people accepted Christianity in 1870) spent a year on the island, and can bear testimony to the kindly nature and honesty of its people. During all the time he lived there as

* Rev. J. E. Newell—Proc. Austr. Assoc. Adv. Sci. for 1895 (1896), p. 609.

† Geogr. Journ. 1895, vi, p. 344.

‡ Officially Vaitupu, otherwise Tracey Island.

§ Becke—*loc. cit.*

|| In Findlay—Directory of the South Pacific Ocean, 1877, p. 753.

¶ Turner, Becke, Newell and Findlay—*loc. cit.* Whitmee—Journ. Anthropol. Inst., viii., 1879, p. 274.

** Moresby—New Guinea, 1876, p. 77.

†† After the Commander of the “Peacock.”

agent for Messrs. John S. De Wolf and Company, of Liverpool, he never had as much as a scrap of tobacco stolen from him, although his trade goods were piled up indiscriminately on the floor of his house, which had neither doors, locks, nor a bolt of any kind. In this, however, the Nanomagans are peculiar—the other islanders are not so particular.* “There is a lagoon here, centre very deep, sides very muddy,” writes Dr. Gill in a MS. account of a visit to this island in 1872, which he has kindly allowed me to peruse. Wilkes, however, denied it a lagoon, and none is shown upon the Admiralty Chart (South Pacific, No. 766, Ed. 1893).

“NIUTAO, Lynx or Speident† Island is an atoll about three and a half miles in circumference, and has two small lagoons. It is said to have had its origin with other islands in two ladies, the one called Pai and the other Vau. They came from the Gilbert Islands with a basket of earth, and wherever they threw it about the islands sprang up. Other traditions say that the people came from Samoa in two canoes which drifted thither. The one went to Vaitupu and the other to Niutao.”‡ “This island,” Moresby informs us, “differs from the others of the group in having no guarding reef, and no companion islands near it. It stands alone in the ocean, scarcely raised above its level, and is simply a huge flat-topped coral rock, two and a half miles by one and a half in extent, which rises perpendicularly from fathomless depths, and is only saved from being washed over by the sea by a narrow shore reef, on which the great surf expends itself. We pulled to the edge of the boiling surf and met canoes, which landed us without a wetting, and were received on the beach with the most intense curiosity by the natives, who had never seen a man-of-war before. They are a well-looking, dark, straight-haired race, and number four hundred and seventeen souls, a large population for so small an island, but their food is abundant, an unlimited supply of cocoanuts, fowls, pigs, flying-fish, skipjack and sharks. . . . Their mode of procuring water is curious. They cut the coral rock to a depth of twenty feet, and make an opening wide at the top and narrowing into three small holes below, which fill with a brackish water as the tide rises. They have not any other supply, but do not need it as they have an unlimited supply of cocoanut milk.”§

* Becke—*loc. cit.*

† So named by Wilkes, who sighted the island in 1841, after the purser of the “Peacock.” “Niutao,” says Gill (Jottings, p. 1), signifies “baked cocoanut.”

‡ Turner—*loc. cit.* p. 287.

§ *Loc. cit.*, p. 79.

NANOMEA.—This is the northernmost of the Ellice Group, it is probably the San Augustin Island of Murelle (1781), and Taswell and Sherson Islands of the brig "Elizabeth."* (1809). The Rev. S. J. Whitmee† says (1870), "There are two islands within three or four miles of each other connected by a reef, dry at low water. The westerly island is named Lakena; it is nearly round, two miles or more across, well stocked with cocoa-nut and other trees, and has a deep *fresh water* lagoon in its centre. It is not inhabited, but is used by the people of the other island for the cultivation of food. Nanomea, the second island, is about four miles long by one to two wide; it has a shallow water lagoon towards the east end, partially open to the sea. The inhabitants are taken together the finest race of men, so far as muscular development goes, I have ever seen. They are almost a race of giants. I believe nine out of every ten would measure six feet or more high, and their breadth is proportionate to their height. The Englishman resident on the island estimates the population at about one thousand." Becke writes‡ "There were last year eight hundred and thirty people on the two islands, Nanomea and Lakena." Here "the men are heavily bearded, and not a little proud thereof."§

The Ellice Islanders seem ethnologically to have segregated themselves in three groups. Nukulailai and Nukufetau were anciently more or less dependents of Funafuti, with which Vaitupu was allied; all four for instance united in the worship of Foilape or Firaŋi. In 1841, the Nukufetau people described their world to Wilkes as consisting of Funafuti, Vaitupu, and the Tokelaus. Nanomana and Nanomea were closely linked by their extraordinary quarantine rites, Niutao by its position and skull worship was associated with these; the north and south group also differed in their method of making the titi (see *Vegetation post*). As we have already remarked Nui stood apart.

The atoll of Funafuti was discovered by Captain Peyster|| in the "Rebecca," on March 18th, 1819. According to the observations¶ of Captain Wilkes, it lies in Lat. 8° 30' 45" South, Long. 179° 13' 30" East. A position which may otherwise be described as due north of Fiji, and precisely half way between that and the Equator. It is about a thousand miles south-south-west of what Dana considered** as the centre of the great Pacific subsidence.

* Mercantile Magazine, Sept., 1873, p. 257.

† In Findlay—*loc. cit.* p. 755.

‡ *Loc. cit.*

§ J. B. Davis—*Anthrop. Rev.*, vii., 1870, p. 191.

|| Findlay—*loc. cit.*, p. 751.

¶ Wilkes—*Narrative U.S. Exploring Expedition*, 1845, p. 295.

** Dana—*Corals and Coral Islands*, 1872, p. 324.

The nearest high land is the small island of Rotumah, two hundred and sixty miles to the south-west ; but the nearest land of any considerable size is Vanua Levu, four hundred and fifty miles south.

On nearing Funafuti, as with any South Sea atoll, a long low line of vegetation on the horizon gives the first intimation of the approach to land. Looming larger, the tallest palm trees show their plumed heads sharp against the sky. Nearer, if to windward, the dense vegetation is framed by a long white line of ever breaking surf ; to leeward, a beach of sand, dazzling white in the sunshine, limits the forest. Not till the observer has entered the lagoon by one of the navigable channels does the atoll as a whole extend before him. In this instance Dana's poetic comparison* of an atoll to "a garland thrown upon the waters" is scarcely applicable, so many and so wide are the rents in the wreath of foliage.

PHYSICAL STRUCTURE AND GEOLOGY.

The outline of Funafuti is that of a pear, the curved stem of which is directed southwards. On the east or windward side the outline is sketched in most firmly, the thread of reef and palm being here almost continuous ; but on the leeward side so many and so wide are the gaps that the interspaces of surf far exceed those dots where the atoll rim emerges as dry land. The lagoon, a noble sheet of water about ten miles long and eight broad, thus bounded, is plentifully besprinkled with shoals, many of which rise to the surface and "break." Its maximum depth is thirty fathoms, the general level of the floor being about twenty, whence it steeply rises to the beach.

Beyond the atoll rim, I am informed by Captain Mervyn Field, R.N., of H.M.S. "Penguin," that his exhaustive series of soundings developed the interesting fact that Funafuti is not seated on any common ridge, or connected with the other members of the Ellice Group by any bank, but that it rises independently from the abyssal floor of the Pacific. The same was demonstrated to be the case with Nukulailai, and therefore the remainder of the Archipelago will probably prove "a range of deep sea cones," which Dana said† would be so "interesting a discovery." From the reef the atoll sloped steeply outwards to forty fathoms, whence to a hundred and fifty fathoms an almost precipitous cliff surrounded the island. Below this its lower slope, as was suggested to me by Prof. Sollas, compared with the contour of Mount Etna. The outlines of the atoll, as it appears on the surface, are repeated with astonishing fidelity by the five hundred, thousand, and fifteen hundred fathom levels.

* *Loc. cit.*, p. 167.

† *Loc. cit.*, p. 372.

The largest islet of the atoll extends for seven miles, occupying about half the windward side. In shape it resembles a reversed capital L, or more nearly the Australian aboriginal club called "Liangle." The concave side is presented to the lagoon; against the centre of concavity sand has been banked up, so as to greatly increase the diameter of the islet, which here attains its maximum breadth of seven hundred yards. Here is situated the principal or permanent village, Fungafari; here also is the only supply of fresh water and the gardens. North and south of this area the islet rapidly narrows to a width of about a hundred yards, which is maintained for the greater part of its length. About a mile south of the village, at a spot called Luamanif, is a well beaten track, the portage, where, to avoid the long pull by the passage, the natives haul their canoes overland across the islet, a distance of about seventy yards, and launch them on the other side. A considerable area of perhaps a dozen acres in the centre of the islet is occupied by a swamp, which from the fact of being ringed round with *Rhizophora* will be called the Mangrove Swamp. The native name of this locality is, I believe, Tisala. This swamp is somewhat the shape of a sagittate leaf of an aroid like the taro; the tip of the leaf answering to the south-east corner, while the lobes represent two branches, a broad western one stretching nearly across the island and penetrating almost to the village, and a narrow northern branch. Along its whole eastern border the swamp is walled in by a bank of shingle and rolled coral blocks, which rise twelve or fifteen feet above the flat, and on the further side of which the waves break at high tide. This shingle bank is narrowest and lowest in the centre, and carries a few scattered palms and pandanus. On its inland face a strip of *Rhizophora* luxuriates in soft, dark brown, rather deep mud. The chief expanse of the Mangrove Swamp is bare of vegetation, extremely level, of soft decomposing coral rock, whose interstices are filled with mud. At high tide it is covered ankle deep with water which drains away at half ebb. Following the retreating water northward, several large deep pools are encountered in the northern arm. On closer approach these are seen to be in such free communication with the ocean, that not the tides alone but every individual wave pulsates therein. Some have an easterly and westerly disposition, which suggests that they are breaks in the roofs of tunnels which extend under the shingle rampart, and open outside the reef a hundred yards away. A child, I was told, once disappeared into one of these pools, the dead body of which was afterwards recovered on the ocean beach. Striking as may be this natural siphon of the northern arm, by which the rising tide floods the swamp, yet the western limb surpasses it in interest. Here, at a spot a quarter of a mile east of the Mission Church, round flat-topped table-like bosses three to

four feet across rise a few inches above the general level. Just such masses occur as living coral in the reefs in the lagoon, and on flaking off a chip these prove to be a small-pored *Porites*. From these bosses of *Porites* extend in rays for several yards in every direction, thin flat stones on edge like tiles along a garden walk. A glance at a fragment serves to identify the latter as slabs of blue coral, *Heliopora cœrulea*. On drawing Prof. Sollas' attention to this formation, he suggested that the *Porites* and its surrounding star of *Heliopora* evidently both lived *in situ*, and that they could not have existed at their present level where high tide alone bathes them. I am of opinion that the action of the tides is impeded in the Mangrove Swamp, but that the high tide, not the low one, must be the affected level; the height of coral growth is determined by the low tide not the high.

We are therefore here facing unequivocal evidence of elevation in Funafuti to the extent at least of the range of the tide, since low water springs is the highest level to which the *Porites* and *Heliopora* could have reached. They probably also grew in smooth and sheltered water. The cone in which the island rises from the abyss suggests the proximity of volcanic force to give an upward thrust. In Honden Island and Osnaburgh Island Dana* has given striking instances of slightly upheaved atolls.

Around the western edge of the Mangrove Swamp, and most noticeable in the north arm, is an old beach where a breccia of coral fragments in a platform two or three feet above the swamp has been eaten back by wave action. That this breccia formerly extended as a sheet over what is now the surface of the swamp, is indicated by a few isolated and worn cakes of it, outliers in other words, near the centre of the flat; but whether or not it overlaid the *Heliopora* I possess no evidence to show, although I incline to the opinion that it did.†

The beach outside the Mangrove Swamp is furthest to windward of any land in the atoll; reverting to my comparison of the islet to a Liangle, this spot corresponds to the blade of the weapon. In other words it is the most exposed corner of Funafuti.

The history of the Mangrove Swamp as indicated by these features seems to me to be, that a hurricane breaking on the eastern face of Funafuti, tore down the shingle rampart and

* *Loc. cit.*, pp. 333 and 335. Darwin declined (*Structure and Distribution of Coral Reefs*, 1874, p. 169) to accept these evidences of slight elevation, and endeavoured to otherwise explain an apparent instance of it which he observed (*op. cit.*, p. 21) at Keeling Island.

† A too brief note (*Qt. Journ. Geol. Soc.*, 1872, xxviii., p. 381) by S. J. Whitnell (? Rev. S. J. Whitmee) upon raised coral rock *in situ* at Funafuti, may refer to the place I have here described, but I rather suppose that the subfossil coral exposed by the beach section of breccia was mistaken for coral in the position of growth.

eroded the loose coral blocks with the breccia sheet that lay behind it, until the storm had made a breach half across the islet. Afterwards the waves in the usual course of their work rebuilt the shingle bank as it now stands. Before the re-erection of the latter, drifting seeds of mangrove reached the swamp and originated the present thicket.

The shingle embankment referred to continues along the whole windward face of the atoll, being highest at the eastern angle and diminishing north and south where the trade winds strike the beach obliquely. On the leeward side it is entirely absent. Six feet above the usual level of the ocean waves it represents the greatest altitude, the culminating peak, of the atoll. Great blocks of coral packed high and toppled over by gales of past years, all weathered and discoloured, compose the inland face of the bank, their appearance recalling a heap of blackened lava and scorïæ from some volcanic hill side. A similar scene reminded Dana of "a vast field of ruins. Angular masses of coral rock, varying in dimensions from one to a hundred cubic feet, lie piled together in the utmost confusion; and they are so blackened by exposure, or from incrusting lichens, as to resemble the clinkers of Mauna Loa; moreover, they ring like metal under the hammer. Such regions may be traversed by leaping from block to block, with the risk of falling into the many recesses among the huge masses. On breaking an edge from the black masses, the usual white colour of coral is at once apparent."* On the seaward face the blocks of coral are smoothed, rounded, and beach worn, till all semblance of their Actinozoan origin has been ground away.

On examining the beach at low water, the shingle bank was seen to be underlaid throughout, like that of the north arm of the swamp, by a breccia of angular coral fragments, in size usually of a man's head or fist. The corals appeared to belong to the same species as those now thrown up on the beach, some of which, presumably deep water species, only occurred too ground and battered to be worth collecting. A species, apparently a large *Mussa*, I knew well by sight, but was never fortunate enough to find in even tolerable preservation. Here and there this breccia was carved by the waves into fantastic turrets and pinnacles or extended seaward in shelves. The highest point it reached was a little above high tide mark. I thought sometimes that the mode of weathering and the composition of the rock indicated an upper and a lower bed, but of this I could not satisfy myself. The history of this stratum appears to be that fragments of coral torn from the growing edge have been packed in a bank like that now facing the surf, that sea or rain water cemented these into a sheet of breccia, and that a shift of winds set the waves to tear down what

* *Loc. cit.*, p. 178.

they had formerly built.* In general wherever rock appeared on the atoll it was definitely related to the situation. Thus the breccia above described was peculiar to the ocean beach, and was always overlaid by coarse shingle and rough freshly broken coral fragments; on the leeward shore of the atoll the coral-sand-rock always accompanied stretches of clean sand composed of foraminifera, coral and molluscan fragments; again on the lagoon beach of the Funafuti islet there occur low scarps of shingle conglomerate overspread by shingle beaches.

It would appear, therefore, that these rocks were here consolidated under the conditions which still prevail. A little excavation with a crowbar shows the surface to be usually harder than the underlying strata. Often an apparently solid crust when overturned exhibited a lower surface bristling with pebbles that adhered to the mass by one end only. The process of consolidation, whether solution by sea water and deposition or not, having operated apparently on the upper surface and to a slight depth only.

On the outer edge of the reef the surf does not permit much close examination. From the base of the shingle bank or low scarp of breccia, the beach usually stretches seawards for forty or fifty yards in a bare and level expanse, which dries at very low tides in calm weather. It then appears from its Nullipore carpet as a sheet of dull crimson. Moresby noticed this colour on Nanomana Island but erroneously ascribed it to coral.† Deep fissures appear which rapidly widen into crevasses, between which the ground rises into knobs or hillocks, pitted and honeycombed throughout. These breast the surf, beyond them the reef plunges at once into deep water. The coral appears to grow seaward in piers, as these broaden their interstices first form wide trenches, then narrow crevasses that may be stepped across, which clefts tend to be roofed in by growth of Nullipores and are narrowest at the surface, ultimately (proceeding inshore) they become mere fissures and then disappear. This disappearance only refers to the surface, for they probably form tunnels far into the centre of the islet, as shown by the openings through which the sea floods the mangrove swamp. At Nui, the Rev. S. J. Whitmee observed that "the seawater gains access to the central lagoon through the reef underneath the islands. In some it bubbles up at the rise of the tide in the midst of the lagoons, forming immense natural fountains."‡ Further inshore the roof may be broken, and a

* A formation apparently similar to this breccia is described by Darwin from Keeling Island, and by Chamisso from the Marshall Group.—*Structure and Distribution of Coral Reefs*, 1874, pp. 16 & 34.

† Moresby—*New Guinea*, 1876, p. 79.

‡ In article "Polynesia," *Encyc. Britt.*, (9), xix., 1885, p. 420.

sea fountain be forced through the blow-hole by every wave. Peering down into these coral crevasses, for a moment there is shown an abyss as narrow, as green, and as deep as a cleft in some vast alpine glacier, in perspective beyond perspective swim a shoal of brilliant hued fishes, another instant and a rising wave blots out the scene in a volume of spray and foam. Dana remarks that "Among the scattered coral islands north of the Samoan Group, the shore platform is seldom as extensive as at the Paumotus. It rarely exceeds fifty yards in width, and is cut up by passages often reaching almost to the beach. Enderby's Island is one of the number to which this description applies. . . As a key to the explanation of the peculiarities here observed, it may be remarked that the tides in the Paumotus are two to three feet, and about Enderby's Island five to six feet in height."*

Passing inland from the coast anywhere on the windward islets a descent is gradually made on a surface of loose blocks, from a yard in diameter downwards, of broken and decaying coral. The weather has etched the upper faces deeply, and exhibits beautifully the structure particularly of the astrean species. The hardest kinds, as *Montipora*, *Heliopora*, and *Millepora*, had suffered little, but softer species crumbled readily under the blows of a hammer. Most of the surface of the eastern islets was of this inhospitable description, and very cruel to a traveller's limbs and raiment was it. Now and then among the loose, broken blocks, a ridge of breccia running parallel to the islet's length could be detected. Though of so barren an aspect, this country supports a vegetation of Ngia, Ngashu, Fau, Fala, Boua, and palms, sufficiently dense to everywhere shade the ground. Nowhere is this description of country more than a foot or two above highwater mark, and little depressions commonly occur even in places remotest from the sea, where, when high, the tide leaks in and spreads in shallow pools, such are always densely enclosed by a thicket of Ngia and Ngashu.

Traverses across such places suggested to me that the low area of decaying coral blocks represents a final stage of the high shingle bank which faces the ocean; the loss in height resulting from decay and collapse natural to a loosely piled mass, such loss being gradual on retreating from the beach as this hypothesis demands. An accompanying transition in the state of decay may be noted likewise, the blocks furthest from the sea being most rotten. This explanation implies that the islet is growing peripherally, and that seaward from the present embankment another will in the future form. I am prepared to accept this implication, and fortify the position by quoting an opinion in support from that experienced and acute observer, the Rev. S. J.

* *Loc. cit.*, p. 186.

Whitmee,* who writes of Peru in the Gilberts: "The island itself is formed of successive ridges of sand, broken coral, and shells. These ridges are most of them from thirty to fifty feet across, and the hollows formed between them are generally from four to six feet in depth. For some distance, at that end of the island which I examined, they run across, and in the middle they run parallel with the sides of the island. The whole extent examined presented the same appearance, and the ridges were so regular that they gave one the idea of being artificially formed. The waves must exert a mighty force during heavy weather to form these extensive ridges. There is little doubt but each ridge is the result of a single storm. I have already referred, in the notice of Atafu in the Tokelau group, to a similar ridge of smaller dimensions which was thrown up during the present year; and I have seen several small islands of broken coral and shells, which were formed on the reefs in Samoa during a hurricane of a few hours duration."

North and south of the Mangrove Swamp the region of decayed coral blocks does not immediately occur, but a considerable area of sandy soil intervenes. To the south a large tract of this is under cultivation, and more was so used when the atoll carried a larger population. Here also are the wells and bathing pools. To this area Dana's remarks† are quite applicable: "There is but little depth of coral soil, although the land may appear buried in the richest foliage. In fact, the soil is scarcely anything but coral sand. It is seldom discoloured beyond four or five inches, and but little of it to this extent; there is no proper vegetable mould, but only a mixture of darker particles with the white grains of coral sand. It is often rather a coral gravel, and below a foot or two it is usually cemented together into a more or less compact coral sand-rock."

The northernmost islet of the Funafuti atoll stands out of water higher by several feet than does any other. It occurred to me that the whole atoll had indeed a slight tilt from north to south, but I had no opportunity to decide whether it were so. On this particular islet there was richer red soil, plants grow here unseen elsewhere, there is also the best garden with flourishing bananas, not cultivated in a swamp in the usual Ellice Island fashion but on dry ground.

A traverse of a leeward islet crosses formation quite different to that of the windward islets. The dry land is a tolerably level expanse of sandy soil, the islets are not arranged so strictly along the margin of the reef as they are to windward, but may be seated far within its border. The major axis of one islet is even

* Whitmee—A Missionary Cruise in the South Pacific, 1871, p. 35.

† *Loc. cit.* p. 179.

at right angles to the general trend of the reef. From the base of the vegetation a broad sandy beach extends around the islet, it is largely composed of two species of Foraminifera, which Mr. Whitelegge informs me are *Tinoporus baculatus*, Mont., and *Orbitolites complanata*, Lamarck. High water mark indicated by lines of drifted leaves and shells implies a quiet sea. At about half tide mark, especially upon the ocean side, sheets of regularly bedded coral-sand-rock appear, answering in position to the breccia of the windward beaches. At a lower level the shore extends in rough ledges and deep pools for perhaps a hundred yards, beyond this it becomes more level and carries numerous loose boulders of coral rock, as large as an ordinary chair or table; such boulders are known as "niggerheads" on the Great Barrier Reef of Queensland, and have been described by Dana,* Jukes,† and Kent.‡

Everywhere small pebbles§ of pumice the size of a walnut might be collected on the beaches. The natives say that a few years ago much pumice came ashore, coincident with which the fish from without the lagoon became unfit for food. A further account of this pumice will be found in the accompanying Report by my colleague, Dr. T. Cooksey.

"Funafuti," writes Newell,|| is a group of some thirty islets surrounding a lagoon twelve miles in length. . . . The names of many of the islets in this group were given me. Not only here but all through the Ellice Group I found that not merely did every little atoll bear a name, but that the names of atolls and of known spots on these atolls were significant of some fact in its history, either original ownership or some physical feature of the islet, or some historical fact connected with the place. The following names of islets in the Funafuti Group are interesting:—Te Pava (the name of a Samoan, Upolu, war god); Te fua te fe'e, the offspring of the Fe'e (either the ancestor or the god incarnate in the cuttlefish); Aumatupu; Te muri te fala, the end of the Pandanus; Te afu alii, the sweat of the chief; Te puka, the name of a tree;¶ Te puka savilivili; Te fua lopa; Te fua fatu; Fuage'a; Te fala, the pandanus; Te fala o Ingo; Tutanga;

* *Loc. cit.*, p. 179, figs. 1 and 2.

† Jukes—Voyage of the "Fly," 1847, i., p. 16.

‡ Kent—Great Barrier Reef of Queensland, 1893, pp. 49, 104, Pl. xxx.

§ These pebbles of pumice are of very frequent occurrence on the shores of the inlets of the east coast of Australia. This subject has been discussed at length by Messrs. David and Etheridge in *Rec. Geol. Surv. N.S.W.*, 1890, ii., 2, p. 27. And for Polynesia see Guppy—The Solomon Islands, their Geology, &c., 1887, Chap. x.

|| *Loc. cit.* p. 608.

¶ *Hernandia peltata*, Meissn.—See *Vegetation post*.

Te ngasu ;* Te afua fou, the new beginning (the name refers to an unfortunate incident in connection with their first contact with the white man, and their first knowledge of the deadly firearms of the foreigner. A vessel called at the mouth of the lagoon, and the natives were allowed on board. On leaving one of them stole a bucket.† The canoe containing the thief was pursued, and, to the astonishment and dismay of the company, the man in pursuit was able to produce lightning and thunder and to inflict death); Avalau (this islet is said to possess a spring of fresh water); Motu ninie, ironwood islands; Nuku savalivali, the place where people can walk about; Motu loa, long island; Motu sa Nafa, the island of the Nafa clan; Te rere; Te fata, the platform; Funafala, the pandanus of Funa, the name of a chief, after whom also the group has been named Funafuti."

An exact survey of the islets of the atoll was executed by Captain Mervyn Field and his officers during the visit of H.M.S. "Penguin," and for further details their work in the forthcoming Admiralty chart may be consulted.

The lagoon at Funafuti appears to be in course of filling up, though the agencies at work must take long to make a perceptible advance in so huge a task. In Vaitupu this has been partly, and in Nurakita wholly accomplished. The land gains upon the water at many points. A small cay in the heart of the lake presents a permanently dry surface, while low tide shows many patches of sand and gravel above water. Scattered over the whole lagoon are numerous small reefs of upwards of an acre in extent, for all of which (being good fishing grounds) the natives have distinguishing names as Fasua Takau, the Clam Shell Reef. These reefs are in a thriving condition and evidently growing vigorously. Those near enough to the surface to permit wading at low water, offered to the naturalists of the Expedition their best collecting grounds. Other reefs lying deeper seen through a water telescope, called to fancy a "rockery" in some botanical garden, if for boulders be taken round masses of *Porites* or *Goniastrea*, tufts of soft *Alcyonaria* for ferns, and branching *Gorgonia* for shrubs.

Along the centre of the concave side of the main islet is banked, as already mentioned, masses of sand which are arranged in low broad undulations, parallel to the long axis of the islet. Nowhere do they form dunes as occur on other atolls, probably because an active vegetation fences off the wind. This increment of sand is still adding to the islet's breadth. A space was pointed out in front of the village where a man could formerly take a

* *Scaevola kaenigii*, Vahl. See Vegetation.

† The version I heard on Funafuti was that the ship's chronometer was taken through a port of the captain's cabin,—a much more serious offence.

deep dive, but which is now barely knee deep. Mr. O'Brien, the resident trader, told me that within his recollection this place had become much shallower. A similar spot in the lagoon of Nukulailai was shown to me by Mr. Collins, the local trader, who had remarked that it had shoaled visibly during his residence on the atoll.

North and south of Funafuti islet are shallow passages* a few hundred yards in width, interruptions in the thread of land which encloses the lagoon but not in the reef rim upon which the islets stand. At low water these are nearly dry, to windward the surf breaks upon the outer edge of the reef, which continues from islet to islet without reference to the passage, and to which my previous description of low mounds, crevasses, and inner platform applies. Within these the passage offers a broad, almost level floor of shingle and rolled blocks. This area is nearly destitute of life, the great rush of water sweeping all before it and the unstable floor giving little holdfast. A few of the hardest Gasteropods and odd scraps of living coral contrive however to withstand these adversities. Coming to the lagoon shore the passage floor is seen to extend into it in a fan, identical in shape and structure with the fan a mountain torrent spreads on entering a lake. Below and beyond the steep delta slope a coral garden stocked with fish, shells, sea anemones, and many other pretty things, flourishes exceedingly. A collector remembers with what cupidity he, floating over them in a canoe, gazed at treasures so near in the clear water and yet so far from sketch book or microscope. As well as I could ascertain the water, driven by the surf, pours from without to within across the passage, during ebb tide as well as flood. Whether or not these passages are growing into islets there was nothing to show, if so the shingle floor might represent the breccia in course of formation; but certainly the filling in of the lagoon proceeds at the passage delta.

SUMMARY OF PRECEDING GEOLOGICAL OBSERVATIONS.

1. An elevation of Funafuti by at least four feet is proved by dead sub-fossil reef-corals in the position of life near high water mark.
2. Darwin's theory of coral reefs as opposed to Murray's is favoured by these facts:—Firstly, soundings show the atoll to be planted not on a bank but on a cone; secondly, they also show it girdled by a precipitous submarine cliff, explicable only on the subsidence theory; thirdly, our observations and the experience of residents agree that the lagoon is filling up, whereas Murray demands its excavation.

* These "passages" are not to be confounded with the deep and navigable channels through which warships may enter the lagoon.

3. A peripheral growth at present level is indicated on both sides of the islets.

CLIMATE.

During our visit in the "winter" of this latitude, the thermometer never fell below 75° ; when it approached this minimum the natives seemed to feel the cold, as their bare skins puckered into "gooseflesh." A native who had visited Auckland, New Zealand, amused me with a description of how in that, to him, distant and frigid clime, he saw his breath appear one cold morning "like smoke," and how he felt alarmed that he were stricken by some dire malady. The highest temperature we noticed was about 92° , sometimes for days together the thermometer would oscillate within a few degrees of 80° , the latter being the temperature of the surface of the lagoon. The readings of the wet and dry bulb were seldom far apart in that humid atmosphere.

A week hardly ever passed without rain, and it sometimes poured hard all day.

The wind rarely shifted out of the east. Our hut upon the lee side of the islet had its sides open to the weather, yet it seldom blew enough there to extinguish a match. Only twice do I recollect a gust from the westward strong enough to scatter loose papers on the table.

The zodiacal light was sometimes seen distinctly.

Hurricanes seldom occur, but a few have impressed their memory upon residents. I have already stated my belief that the Mangrove Swamp is a scar upon the islet resulting from one of these conflicts of the elements. "The group," says Becke, "suffers but seldom from droughts or hurricanes, although the terrible drought experienced in the near-to Gilbert Group in 1892, which has not yet broken up, has also affected the Ellices, and at the present time Nanomea and Nanomaga present a parched up appearance. A heavy blow in 1890 also did terrible havoc among the cocoanuts, which had not the strength to bear up against the drought."* Describing the Gilbert Islands, Woodford† remarks: "I suspect that it is not till the cyclone in its course reaches a latitude of about 12° to 18° from the equator, that the level of the water accompanying it attains a height sufficient to do serious damage. Were it not so, the Ellice Group, of similar formation, which lies much further to the southward, would be rendered uninhabitable. A wave of the height of eighteen feet would be sufficient to sweep away the whole of the population of the Gilbert and Ellice Groups."

* Becke—*loc. cit.* † Woodford—*loc. cit.*

VEGETATION.

I regret that I was unable to form a Botanical Collection in Funafuti. I did indeed attempt to dry plants in blotting paper, but the extreme moisture of the climate caused the specimens to rot even in the press. Zoological study being the principal aim of my visit, and the exhausting work of reef collecting leaving little time or energy, botany was reluctantly sacrificed; specimens of such plants only as related to ethnological inquiry being preserved in a solution of two or three per cent. of formol.

The study of atoll floras was initiated by Henslow's examination* of the plants collected by Darwin on the Keeling Islands, our knowledge of which was expanded by Forbes† and by Guppy.‡ Lists of plants from the Marshall Islands,§ Maldon Island,|| Gilbert Islands,¶ Sikaiana Island,** Caroline Island,†† and Fanning Island,‡‡ show a small number of the same species repeated from atoll to atoll over enormous distances across the Pacific Ocean. The identity of the vegetation possessed by tiny islets separated by thousands of miles of deepest ocean is very striking, since paradoxically they present a greater continuity of life range than any continent can show. The inferences deducible from the distribution of atoll plants are so admirably drawn by Dr. H. B. Guppy, and are so entirely in accordance with my own conclusions, that I extract from his article "The Polynesians and their Plant-names,"§§ the following expression of his views:—

"The low coral islands and the shores of the more elevated and mountainous islands are occupied by plants such as *Barringtonia speciosa*, *Calophyllum inophyllum*, the Mangrove, *Morinda citrifolia*, the Pandanus, *Thespesia populnea*, &c., that are known to be dispersed by the currents; and they are all plants that are widely distributed over the Indian and Pacific Oceans. The only doubt arises as to the particular route along which the floating seed were drifted, and if that can be established we may obtain a clue as to the route pursued by the Polynesians. Now a species that, like *Barringtonia speciosa* or *Thespesia populnea*,

* Florula Keelingensis, Ann. Nat. Hist., i., 1838, p. 337.

† Forbes—A Naturalist's Wanderings in the Eastern Archipelago, 1885, p. 42.

‡ Nature, xli., 1890, p. 492.

§ E. Betsche, Berliner Gartenzeitung, 1844.

|| Hooker in Hemsley, Challenger Reports—Botany, i., 1885, p. 18.

¶ Woodford—Geogr. Journ., vi., 1895, p. 346.

** Beck—Ann. K.K. Naturhist. Hofmus., iii., 1888, pp. 251–256.

†† Dixon—Mem. Nat. Acad. Sci., ii., 1884, p. 88.

‡‡ Hemsley—"Challenger" Reports—Botany, iii., 1885, p. 116.

§§ Trans. Vict. Inst., 1896.

is almost universally distributed in the tropical islands of the Pacific can scarcely aid us in the matter. If, however, we can find a littoral plant that has only partly performed the traverse of this region, then we shall possess in the interrupted operation an important piece of evidence. The Mangrove (*Rhizophora*, *Bruguiera*, &c.) is absent, or very rare, in Eastern Polynesia, but unfortunately for our purpose this is in great part explained by the lack of a suitable station on the precipitous shores of the larger islands. We have, however, in *Nipa fruticans* a plant well fitted for our object, and one well known to be dispersed by the currents. For a littoral species it has a limited range. It is found on the tropical shores of Asia, east of the Ganges, and in the Indian Archipelago, where it abounds; and there is no question as to its great antiquity in this region. Now the Nipa Palm, as it is sometimes termed, has attempted to reach Polynesia by two routes from the Indian Archipelago, viz., by Melanesia and Micronesia. Along the first route it has in the course of ages reached the Solomon Islands, where I found it in 1884. Along the second route it has extended its range to Ualan or Kusaie, at the eastern end of the Caroline Group, where it was observed by Kittlitz about seventy years ago. Since its intrusion so far into the Pacific seems to have escaped the notice of later botanists, and as no reference is made to it by Hemsley in his account of the floras of oceanic islands, given in his 'Botany of the "Challenger,"' I may here remark that it is described in general terms in the narrative of Kittlitz, and is figured in his 'Views of the Pacific Vegetation,' where it was also identified and noted by Dr. Seemann in his English edition of the 'Views.' Now the island of Kusaie lies in the course of the Pacific Counter Current, which runs to the eastward from the Malay Archipelago right across the Pacific between the parallels of about 4° to 8° N. Here the Nipa Palm has reached the last spot where it could find a station. Beyond lie the coral atolls of the Marshall Group that could afford no home to a plant that frequents the extensive coast swamps, and lines the mouths of large rivers in Asia and in the Archipelago. Most of the familiar littoral plants of Polynesia have probably reached their present home by the path attempted in vain by the Nipa Palm. Since they for the most part frequent coral islands, the atolls of the Marshall, Gilbert, and Ellice Groups would form so many stepping-stones by which, in the season of the north-west winds, they would be able to find their way to Samoa and Fiji in spite of the westerly drift of the Equatorial Current."*

* Among Mollusca the *Trochomorphæ* would seem to have "reached their present home by the path attempted in vain by the Nipa Palm;" and *Rhysota sowerbyana*, Pfr., to have accompanied the Nipa to the Carolines, and like it to have there "reached the last spot where it could find a station."—C.H.

No account of the botany of the Ellice Group appears to have been published. In his recent works on Polynesian Botany, Drake del Castello neglects to make any reference to this Archipelago. A few plants were gathered by the Rev. S. J. Whitmee during his missionary tours and presented to the Kew Herbarium. From this collection Hemsley in the "Challenger Reports—Botany" incidentally quotes *Suriana maritima*, Linn., and *Rhizophora mucronata*, Lamarck, from Funafuti itself, and from the Ellice in general the following:—*Ochrosia parviflora*, Henslow, *Tournefortia argentea*, Linn. f., *Acalypha grandis*, Benth., *Pipturus argenteus*, Weld, *Guettarda speciosa*, Linn., *Premna taitensis*, Schauer, *Nephrolepis exaltata*, Schott, and *Octoblepharum smaragdinum*, Mitten.

The vegetable monarch of the atoll world is the coconut palm (*Cocos nucifera*, Linn.), tall individuals of which, rearing their plumes to a height of over eighty feet, give to the mariner his first landfall. Every available rod of dry land is planted with coconuts, one tiny islet, a mere shingle bank, so swept with spray that lichens are the only other vegetable life, yet grows three poor stunted and battered palms. It is to be emphasised that all coconuts are *planted*; the idea of a wild palm being as strange in Funafuti as that of a wild peach might be in England. Gill in describing the primeval forest of the uninhabited island of Nassau in 1862, alludes to but a single coconut tree among the indigenous vegetation.* I doubt whether, despite popular opinion to the contrary, a wild coconut palm is to be found throughout the breadth of the Pacific. Certainly it is most rare, again contrary to popular theory, for a drifted coconut thrown upon the beach by winds and waves to produce a tree.† So intimately is this palm now associated with native life that it is difficult to imagine an atoll before its introduction.

* Gill—Jottings from the Pacific, 1885, p. 30.

† From eye-witnesses I have heard of several wild coconut palms on Facing Island, Queensland, and again of one at Emu Park, Queensland. But, if the popular idea were correct, the Queensland beaches should have presented many hundred miles of coconut groves to their earliest explorers, receiving, as I can testify they do, abundance of drifted nuts and fulfilling every requirement of soil and climate. As Jukes says: "The entire absence of these trees from every part of Australia is a most striking fact, since it is I believe the only country in the world so much of which lies within the tropics in which they have never been found."—(Voy. "Fly," i., 1847, p. 132.) I have been told by Queensland Aborigines that they always tore up and ate any sprouting nuts they might find, but even this scarcely accounts for the remarkable absence of the coconut palm from Queensland. Guppy's remarks on the germination of stranded coconuts (Nature, xli., p. 492) will repay perusal, also Dana's in Corals and Coral Islands, 1872, p. 181. Where the original home of this palm was, has been discussed at length by Seemann in the Flora Vitiensis, and by De Candolle—Origin of Cultivated Plants, 1884, p. 429.

Though romance and poetry have always linked together reef and palm, yet truth to tell, the coconut does not attain its greatest luxuriance upon the low reef islands. To an eye, not to mention an appetite, accustomed to the coconuts of New Guinea, the fruit of Funafuti seems to be dwarfed and stunted, and the palm trunks to be small and slender. A hundred nuts on a stem is a maximum yield for Funafuti, but double that amount is obtained elsewhere. "As big as a Rotumah nut," is a phrase often heard upon Funafuti, the richer soil of that high island producing larger nuts than the atolls; the shells of very large nuts being valued for flasks and toddy vessels.

Native traditions point not only to the fact that the coconut is an introduced plant, but that the date of its introduction into Funafuti is, historically speaking, comparatively modern, possibly a couple of centuries ago. Certain of the tallest and presumably oldest* palms about the principal village are known as "Touassa's trees," having been planted in the reign of that chieftain. Tradition narrates how the priest Erivada despatched double canoes, "fouroua," or ocean-going craft, to Vaitupu to bring thence seed nuts, Vaitupu having previously received the coconut from the Gilberts. On the canoes returning with their cargo, the sprouting nuts were dexteriously split so that the spongy core could be extracted for food, while the germinating plant, uninjured by this treatment, was cultivated. At this period land other than the village site and the taro gardens first acquired a value, and the whole atoll was then parcelled out among the tribe, each man proceeding to plant his portion with coconuts. Two generations ago so valuable were the nuts that to steal them was a crime which these gentle islanders punished by drowning the culprit in the lagoon. Two varieties of coconut are recognised, the sweet nut "uta maunga" and bitter "niu."

When the nut is a couple of inches long it is called "kaieri," a little older† when the creamy deposit begins to form it is "mukkamuk," the contained liquid being "swanu," later when it is sufficiently ripe to be plucked for drinking the nut is termed "bee," the milk of which is "swabee," and the kernel "ingati," a more mature nut whose shell begins to turn black is "mutta-mutta," and when the nut drops naturally from the tree it is "niu." A store of these old nuts is kept always in the huts against time of famine, they are partially husked, but care is

* Dr. Gill states that "The coconut palm attains the age of from 180 to 200 years in well sheltered places."—Jottings from the Pacific, 1885, p. 203.

† The stage in ripeness which the nut has reached is ascertained by tapping on it with the knuckles, as in Fiji. See Seemann—*Flora Vitiensis*, 1865-73, p. 278.

taken to leave the husk intact over the "eyes," else the cockroaches would gnaw through at this point and spoil the fruit. A rib of husk like the crest on a fireman's helmet is usually left, and the nuts are tied in couples by a wisp of husk fibre. After the lapse of a year the liquid has dried out, and the kernel turning red and soft is considered more palatable and termed "tukkatukka gea;" this is eaten with bonito. Preserved for three years the kernel turns black and still softer, and, though it now stings the tongue, is yet thought wholesome; this stage is known as "tukkatukka kula." In a sprouting nut the contained liquid turns to a white spongy mass filling the cavity. I found this, as do the natives, an agreeable food. From the old times the people here have extracted (by what process I unfortunately neglected to ascertain) coconut oil, with which, scented, they anoint themselves.

In former years a considerable trade was done in coconut oil locally expressed and casked. The dried kernel or copra now furnishes the sole export of Funafuti, amounting annually to about 8,000 lbs. In return the natives receive through the local trader, tobacco, calico, tools and other requirements. Out of the revenue so obtained, the salary of the native missionary teacher and the taxes due to the Imperial Government are both paid.

Palms devoted to the manufacture of toddy (Fig. 1) are readily distinguished by having step notches cut in their trunks. Every month the palm puts forth a budding spathe. In toddy palms this is not permitted to develop into flower and fruit, but on its first appearance is lashed round with twine, "marled" in seafaring language, from the base to the apex. The peduncle of the spathe is scraped and slightly split to allow it to bend more freely. Then the spathe is bent downwards gradually by tying down the tip for two or three days, the cord being shortened at intervals, till the spathe has acquired the proper inclination. Three or four inches are cut off with a knife from the tip, to which a little spout or gutter of leaf is attached. This spout guides the drip of the sap into an empty coconut shell hung from the spathe. Twice a day a lad ascends the tree, unbinds the tip, shaves a little off it with his knife to make the sap run freer, re-binds it and exchanges the full shell for an empty one. Several spathes in one palm are in operation simultaneously.

The juice so obtained is strained, and lest it should turn sour is kept warm in a coconut shell by the fire. "Freshly drawn from the tree, it is of an agreeable taste resembling ginger-beer."* When sufficient is accumulated it is boiled down to molasses, from which a native sweetmeat is made. For the following recipe I am indebted to a Funafuti lady: "Beret," adopted from the

* Woodford—*loc. cit.*



Fig. 1.—Method of collecting sap dropping from wounded spathes (toddy) into suspended coconut-shell flasks.

Gilbert Islands, take hard old coconut kernel, grate fine, dry in the sun and pound to the consistency of oatmeal; upon this pour boiling syrup of molasses. Water sweetened with molasses is an ordinary drink, and as an alternative to coconut milk a thrifty householder pointed out that the supply of beverage for his family from one tree yielding toddy, equalled that from ten trees yielding nuts. The Ellice Islanders, who were also unacquainted with kava or betelnut, never fermented or distilled their toddy into an intoxicant like the Gilbert Islanders, among whom free

indulgence in toddy was the usual prelude to murderous fights. The manufacture of toddy is an art unknown to either Polynesians or Melanesians, and was certainly derived from Micronesia, reaching in the Ellice its furthest extension southward.

The green heart of a coconut palm being only to be obtained by sacrificing the tree, was a dainty seldom eaten by the islanders.

The timber of the palm was not as far as my observation went ever employed by the natives. The only insect foes to the palm in Funafuti were the white ants, which committed much damage by eating away the trunk a few feet from the ground. I saw several tall palms snapped by the wind where these pests had weakened the stem. My colleague, Mr. W. J. Rainbow, recognised in this pest *Calotermes marginipennis*, Latr.

The cultivation of the coconut is confined to the simple operations of placing a sprouting nut where it is to grow, of clearing the shrubs and vines from around it, and of gathering the produce. The work of collecting and husking the nuts devolves solely upon the men. For climbing the palms a stout rope loop, "kafunga," is twisted into a figure of eight, into this each foot is thrust as far as the instep. Placing his hands around the stem the man leaps on to the trunk, resting his manacled feet on either side of it. Raising his hands to a higher grasp he makes another leap, and ascends the tree by bounds of a couple of feet or so. Arrived at the summit he plucks from his belt a short notched stick and attached cord, "kouteki." Applying the stick against the palm stem like a ship's crosstrees against her mast, he winds the rope half round the trunk, over the notch on the stick, back round the tree and over the other notched end. Repeating this twice or thrice the stick is securely hitched to the trunk, and the native standing upon the crosstrees may conveniently do his work. A nut is gathered by seizing the apex with the fingers and twirling it round till the twisted stalk breaks, when the nut is allowed to drop to the ground.

Husking is effected by fixing a stout stake, which presents a sharp spear point, in the ground at an angle of about 45°. The nut held in both hands is driven against the stake so that the point penetrates the husk but not the shell, and with a twist a strip of husk is wrenched off. After two or three repetitions the husk is torn off, except a strip by which it is fastened to another nut. The labourer returns from his work with his plane iron adze caught in a loop of the kafunga, and these with the koutekei slung with his freshly husked nuts from the husking stake, a valued implement and potential weapon, over his shoulder.

A proprietor wishing his tree to be untouched resorts to the "Niu tabu," (Fig. 2) effected by tying a coconut frond around the stem. This widespread South Sea warning, equivalent to our "Trespassers will be prosecuted," I saw in use throughout British

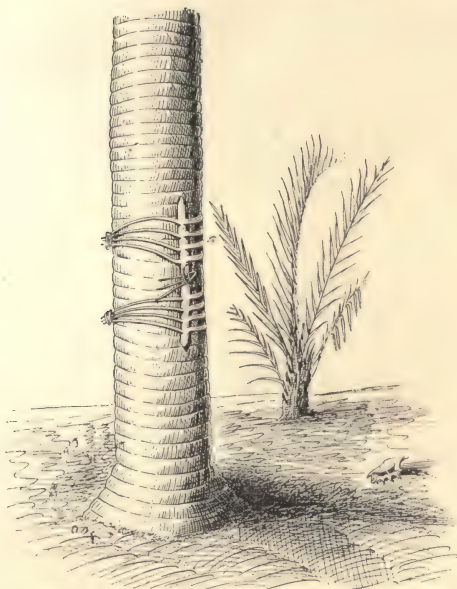


Fig. 2.—A palm reserved by the “Niu Tabu.”

New Guinea, and the Rev. W. W. Gill described* it in Rarotonga. There it is held to represent the owner clasping the tree with his arms and legs, separate bunches of pinnules being knotted to represent the limbs. Dr. Gill tells me that in old Rarotonga, if the midrib of the niu tabu was injured the owner would consider that his spine was figuratively broken, a mortal injury only to be atoned by the blood of the offender. In Tonga the trespasser incurred a curse that his child would die within the year, but in peaceful Funafuti I did not learn of any dire evil befalling the offender. The tip of the coconut frond, the sacred “iku kukau,” was a religious emblem in former days.†

Anyone athirst in another man's land was in Funafuti at liberty to pluck his neighbour's coconut, but he was expected to report the circumstance to the owner on his return.

* Gill—Jottings from the Pacific, 1885, p. 205.

† Gill—*loc. cit.*, pp. 15 and 22. On Nukufetau the American Expedition observed a coconut leaflet tied around the neck, probably as a sign of amity and peace. Wilkes—Narr. Amer. Explor. Exped., v., 1845, p. 43.

Baskets similar to, but not identical with that recently figured and described* by the writer from New Guinea, are constructed from palm fronds, as are trays for carrying fish, eyeshades, and rough mats for the floors and walls of houses. Rough dresses, "titi," for working in are made from palm leaves. Temporary huts are thatched with coconut, but pandanus replaces it in permanent residences.† A leaning palm is used to collect rain water (Fig. 3),

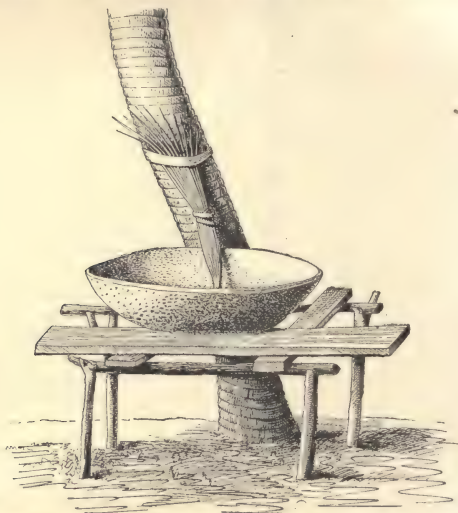


Fig. 3.—Method of draining rain water from a leaning palm.

which trickling down the stem is turned by a wisp of leaves and caught in a wooden trough. The fashion is not in vogue in Funafuti which Dana‡ describes from the neighbouring Tokelaus as follows: "Water is sometimes obtained by making a large

* Proc. Linn. Soc. N.S.W. (2) x., 1895, p. 615, Pl. lviii., f. 2.

† "The thatch of Atupa's house [in Nanomanga] is merely the leaf of the coconut, which is very pervious to rain; whilst the idol-temples are well covered with the leaf of *Pandanus odoratissimus*, the finest thatch in the world. We suggested to a chief that the king's dwelling might have a better thatch. He replied, "The king's house is thatched with coconut leaves, not with pandanus, because he is but mortal." The same feeling formerly existed on Mangaia with reference to this celebrated thatch tree." Gill—Jottings from the Pacific, 1885, p. 23.

‡ Loc. cit. p. 284.

cavity in the body of a coconut tree, two feet or so from the ground. At the Duke of York's Island, and probably also at the adjacent Bowditch Island, this method is put in practice; the cavities hold five or six gallons of water."

The dried leaves tied in bundles are used at night for torches while fishing.

Fibre for sinnet is obtained by macerating green coconut husk for three or four weeks in fresh or salt water, such is known as "loukafa."

A kind of fish trap like our crab pot was wove in basket work from the roots of the palm.

After the coconut the principal tree, both in numbers and utility, is the Fala, Screw Pine, probably *Pandanus odoratisimus*, Linn., but the confused literature* of this difficult genus has not allowed a satisfactory identification of this species. The natives recognise and name several varieties of the native Fala, but I do not know whether these are botanical species. On the third islet south of the permanent village I remarked an apparently starved form with scanty foliage and slender limbs. Approaching the atoll from the sea, the pyramidal shape and vivid green of the Fala enables the eye to detect it before any other indigenous plant. It extends over the whole of every islet, and appears to have no especial choice of soil or situation, attaining a height of 25 - 30 feet, and a diameter of trunk of 12 - 14 inches. The facettied fruit, "fui Fala," about the size of a man's head, is orange-red when ripe and then emits a sweet smell, three or four in different stages of maturity being usually carried on one tree. The fruit being broken open the proximal soft portion of the phalanges is chewed. The sweet sugary taste is a favourite with adults and children alike, and meets the approval of the Robber Crab, *Birgus latro*, but does not commend itself to a European palate. Having chewed the ends into the semblance of a paint brush, the eater throws the phalanges away and never opens them for the edible seeds they contain. There appears to be no private property in Pandanus, anyone may take any ripe fruit he may meet.

The trunk and branches of the Fandango, as the beach-combers call it, are soft and useless for fuel or building, but the leaves, "lau Fala," yield material for the local arts and manufactures. For thatch the leaves are dressed, stripped of their thorns, folded in a row over a batten and pinned by a riblet of palm frond; battens so loaded are arranged on the roof one above another with a considerable lap. Such a thatch is excellent and lasts four or five years. The leaves yields material for fine mats, and

* Vide Balfour, Observations on the genus Pandanus, Journ. Linn. Soc. Bot. xvii. p. 54.

is one of the fabrics for the titi, or native kilt. These leaves readily take a dye, and patterns of red, white and black, have of old figured in the mats and dresses. The aerial roots were in other atolls of the Ellice chewed* into fibre for the titi. "It is believed to attain to a great age. . . I have seen the veritable screw-pine on which Mautara, some hundred and fifty years ago, disembowelled Kikau in revenge for the murder of his son Teuanuku. The tree was uprooted in the cyclone of 1860, or it might well have lived on for many a long year."†

A different Pandanus from the wild one is cultivated near the village, it has a sweeter fruit, twice as large as the indigenous species, longer, broader leaves, and stouter stem. The natives call it the Fala kai, edible Screw Pine, and they told me that it had been introduced from the Gilbert Islands. This is probably the species mentioned by the Rev. S. J. Whitmee, who writes of Peru:‡ "The natives appear to value the Pandanus even more than the cocoanut palm. They consume immense quantities of the fruit raw, and the variety which they cultivate in the Gilbert Group (which is much superior to that found in the Ellice Islands, and immeasurably superior to the kind cultivated in Samoa) produces a very palatable fruit. The women prepare a kind of cake by baking the fruit till it becomes soft; they then pound a large number in a large mat, and spread the prepared pulp in cakes two or three feet wide by six or eight long, and one-sixth of an inch thick. The whole is then dried in the sun, and made into a roll like an ancient manuscript. This keeps for a length of time and tastes something like old dates."

"In the Line Islands, during frequent seasons of drought, when the cocoanut palm ceases to bear fruit, the natives contrive to exist upon fish and the drupes of the never failing screw pine. The inner part of the drupe is fleshy and pleasantly sweet. Several tiny kernels, in extremely hard shells, fill up the outer part. On many of the Gilbert Islands preparations of the Pandanus were presented to us, as the most valuable gifts they could bestow. First, the ripe fleshy parts of the drupe, pounded into a flat cake, in appearance like a mass of pressed oakum; this we could not eat. Next came extremely thin, paper like stuff, consisting of the sugary juice of the fruit dried in the sun; this was very palatable. Lastly came a sort of sawdust, or fine nutritious particles out of the kernel and drupe dried; this too

* In the New Hebrides the petticoat worn by women and girls is prepared from the exposed roots of the Pandanus by splitting and chewing them. Gill—Jottings from the Pacific, 1885, p. 186.

† Gill—*loc. cit.*, p. 187.

‡ Whitmee—A Missionary Cruise in the South Pacific, Sydney, 1871, p. 36.

was very nice, but it would take a great deal of such food to satisfy the appetite.”*

Leichhardt writes of Northern Australia: “At the deserted camp of the natives, which I visited yesterday, I saw half a cone of the Pandanus covered up in hot ashes, large vessels (koolimans) filled with water in which roasted seed-vessels were soaking; seed vessels which had been soaked, were roasting on the coals, and large quantities of them broken on stones and deprived of their seeds. This seems to shew that, in preparing the fruit when ripe for use, it is first baked in hot ashes, then soaked in water to obtain the sweet substance contained between its fibres, after which it is put on the coals and roasted to render it brittle, when it is broken to obtain the kernels.”†

In Funafuti the children make necklaces out of bits of the brightly coloured nuts.‡

Of the timber trees the most imposing is the Fetau (*Calophyllum inophyllum*, Linn.). On the lagoon side of the north-eastern islet and overhanging the water are some handsome examples of this tree forty feet in height and six or seven in diameter, whose roots extend downwards to the hightide mark, and clasp the rocks in the fashion of the Maritime Pines of Europe, or the Spotted Gums of Australia. The rough barked, short, stout trunk branches like an oak abruptly into heavy, thick limbs. The foliage is dense, glossy and dark green; among which is borne a profusion of delicate, sweet smelling, white flowers, greatly valued by the natives, and woven by them into garlands for feasts and festivals. On the main islet were a few small trees, but the species was not abundant there. I did not notice the hard dark timber in use by the natives. Probably it was not workable by the shell adzes used before civilisation.§

Another of the taller timber trees is the Pouka|| (*Hernandia peltata*, Meissn.). On a sandy flat just behind the village, is a wood chiefly composed of this species. Hemmed in by each other and the palms they have shot up into straight, unbranched, slender saplings, forty feet high and twenty inches in diameter;

* Gill—*loc. cit.*, p. 185.

† Leichhardt—*Journal of an Overland Expedition in Australia*, 1847, p. 406.

‡ As described by Gill—*loc. cit.*, p. 186.

§ Seemann (*Flora Vitiensis*, 1865-73, p. 12) says of the oil of this tree in Fiji, “the natives use it for polishing arms and greasing their bodies, when coconut is not at hand. The leaves are torn in small pieces, soaked in water for a night and then used for washing inflamed eyes. Boats and canoes are built of the wood and it is named with the Vesi (*Azelia bijuga*) as the best timber produced in Fiji.”

|| “Buka” in Rarotonga—Gill, *loc. cit.*, p. 166.

these, the first examples noted, were too lofty to show flower or fruit, but the peltate leaf, alluded to by the specific name, enabled me to recognise later the species, in a graceful round topped tree, twenty feet high, growing in the open. The curious capsule of the bell shaped fruit recalled that of the Cape Gooseberry. During our stay on Funafuti several canoes, "vaka," were built, all of which were carved out of the soft white Pouka wood, together with their accessories, balers, outriggers and paddles. In past times, from seed of this, the pigment used in tatooing was made.

For posts and the frames of houses the natives had recourse to the hard, heavy, white wood of the Fau (*Ochrosia parviflora*, Henslow), a smooth barked, small, round topped tree, twenty-five feet in height and a foot in diameter, which flourished among broken coral debris, independent of sand or soil. In hot weather the dense foliage of large, smooth, glossy leaves offered a refreshing shade. The nuts, which Darwin aptly compared to walnuts in appearance, turn yellow when ripe, and hang from long stalks in clusters of twos and threes. Beneath the tree are thickly scattered on the ground the fallen fruit, looking, when the outer rind decays, as if meshed in netting. No use is made of these nuts by the natives.*

Only one clump of the handsome *Barringtonia butonica*, Forst., was seen, it grew a little beyond the north arm of the mangrove swamp. I am not aware if the Rarotongan method† of poisoning fish with *Barringtonia* was practised by the Ellice Islanders. Of the uses to which this tree is put in Fiji, Seemann writes: "A magnificent seaside tree, from which liku (woman's dress) is made. The large square fruits are used by the natives for floats of fishing nets, and in a favourite game (veitegi vutu). The outer portion of the fruit, which is poisonous, is employed for stupefying fish, for the purpose of catching them."‡

Around the swamp a hedge of Tonga (*Rhizophora mucronata*, Lamk.) extended for most of its circumference. This was the only spot it inhabited in the atoll, and no other species of mangrove grows in Funafuti. The arched hoop-like roots, springing high from the trunk, stretch out for yards across the mud, and from them spring smaller and yet smaller hoops that anchor the tree further and further into the swamp. The pendulous viviparous fruit is called "pika." It is not used for food upon

* In the Solomons, "The fruit of the common littoral tree *Ochrosia parviflora* ("pokosola") contains an edible flat kernel." Guppy—Solomon Islands, 1887, p. 87.

† Gill—*loc. cit.*, p. 140.

‡ Seemann—*loc. cit.*, p. 87. See also Guppy—Solomon Islands, 1887, p. 158.

Funafuti, but is eaten on neighbouring atolls where food is less plentiful.* *Rhizophora* tan was formerly used as a dye, but its place is now taken by European tar. "A mangrove which supplies a black dye" is noted by Dr. Steinbach from the Marshall Islands.† The hard wood of this mangrove was carved into "afa," meshing needles. In Fiji, Dr. Seemann observes of this tree: "The sap has a blood red colour, and is much employed by the natives, amongst whom it is as fashionable to dye their hair red as it was amongst the ladies of ancient Rome, after their roving husbands had become acquainted with the fair locks of the Teutonic race. On the Island of Nukubati I also saw the sap employed by potters for painting their crockery. Just after the pots had been baked, and were still quite hot, a mixture consisting of this fluid and the sap of of *Hibiscus moschatus*, L., was used for that purpose, the colours of the paint remaining almost unchanged after the vessels had become cool and dry. The aerial roots, being very elastic, offer good materials for bows of which the Fijians avail themselves."‡ Both the Solomon Islanders and the Tongans also used this wood for bows.§

The Fo fafini, or Woman's Fibre tree (*Hibiscus tiliaceus*, Linn.), grows in abundance as a small tree thirty feet in height, bearing numerous large, showy, lemon coloured flowers, with a brown centre. The western end of the mangrove swamp was overgrown by a dense thicket of this tree. I did not notice that its very soft white wood was applied to any purpose by the natives. The bark, as elsewhere in the Pacific, is a favourite material with the local costumières, who soak it in sea water for a couple of weeks, dry it in the sun, and bleach it with lime, or stain it red with Nonou bark, or blacken it with charcoal, bonito blood, or Tonga tan. In the Ellice this use of Fo was restricted to Nukulailai, Funafuti, Nukufetau, and Vaitupu, beyond which it was replaced by Pandanus.

Seemann says: "In most countries the fibre of this species is extensively used for cordage, but in Fiji the chief use made of it and that of the foregoing species (*H. tricuspis*) is for women's "liku," a dress consisting of a number of fringes attached to a waistband. The bark of these trees is stripped off, steeped in

* Near Cooktown, Queensland, the writer saw in a black's camp a quantity of *Rhizophora* fruit collected for food, and in Western British New Guinea he learnt that it was resorted to in time of famine. In Proc. Roy. Soc. Qd., v., 1888, p. 11, it is recorded as eaten by the Solomon Islanders. For an allusion to its use as an esculent in Torres Straits, see Haddon—Folklore, i., 1890, p. 190.

† Review, in Geogr. Journ., 1896, p. 297.

‡ Seemann—loc. cit., p. 91.

§ Mariner—Tonga, ii., 1817, p. 287.

water to render it soft and pliable and to allow the fibres to separate. The fibres are either permitted to retain their original whiteness, or they are dyed yellow, red, or black. The yellow colour is imparted with turmeric, the black with mud and the leaves of the Favola (*Terminalia catappa*, Linn.), and the red with the bark of the Kura (*Morinda citrifolia*, Linn.), and that of the Tiri. The liku worn by the common women consists always of one row of fibres, all of the same colour; whilst those worn by ladies of rank are often composed of two or three rows or layers (flounces), every one of which exhibits a different colour. In Captain Cook's time the Tahitians used to suck the bark of this plant when the breadfruit season was unproductive, and the New Caledonians ate it, as they probably still do."*

"It is the Talwalphin of some of our Aborigines, who use the fibre of the bark for fishing lines and nets."† "By the Central Queensland natives the roots and tops are used as food."‡ In Hawaii, Hillebrand says: "The light wood serves for outriggers of canoes, the bark furnishes a tough and pliable bast for ropes, and a decoction of the flowers is a useful emollient in bronchial and intestinal catarrhs.§

Near the village were several bushes of Fo tangata (*Broussonetia papyracea*, Vent.), distinguished from the other Fo|| (*Hibiscus*) as the Man's Fibre tree. These grew as shrubs eight feet high, with slender withy branches and coarsely veined soft leaves; apparently they were limited to two or three acres. No care was bestowed on them, and while on the island I considered the plants to be quite wild. Numerous references to this species, as widely cultivated throughout Polynesia, make me now suspect that this tract had originally been planted. Of Fiji Seemann writes: "The cultivation of the plant does not seem to extend further westwards towards the New Hebrides, New Caledonia, and the Loyalty Groups; nor does it seem to be in vogue amongst the islands of the Indian Archipelago and in India. . . . Materials for the scanty clothing worn by the Fijians are readily supplied by a variety of plants, foremost among which stands the Malo or Paper Mulberry (*Broussonetia papyracea*, Vent.), a middle sized tree, with rough trilobed leaves, cultivated all over Fiji."¶ Hillebrand thought that *B. papyracea* was a native of

* Seemann—*loc. cit.*, p. 18.

† Maiden—*Useful Native Plants*, 1889, p. 624.

‡ Thozet—quoted *id.*

§ Hillebrand—*Flora of the Hawaiian Islands*, 1888, p. 49.

|| "Botanical classification has often no place in vernacular nomenclature, and through some resemblance in habit or in utility plants are often placed together that to a botanist lie far apart." Guppy—*Trans. Vict. Inst.*, 1896.

¶ Seemann—*loc. cit.*, p. 246.

Japan. The bark is used for manufacturing fishing lines, which are white, hard and extremely strong. After it is peeled from the twig the fibre is obtained, not by maceration, but by scraping away the inner and outer layers of bark.

An indigenous Fig is known as Ferra. It resembles the illustration, Pl. lxiv., of *Ficus aspera* in the Flora Vitiensis, producing small green fruit the size of marbles, and rarely attaining an altitude of twenty feet. The root, "djakka ferra," formerly yielded excellent fibre for cordage, equal to that obtained from *Broussonetia*, but is no longer employed. It was manufactured from the bark of the root by peeling, chewing, and drying it in the sun. A dish from the fruit of the Ferra was prepared by pounding it up with coconut milk. In Fiji, "when the plantations of *Broussonetia papyrifera* fail to produce a sufficient quantity of raw material for making native cloth, recourse is had to the Baka, *Ficus obliqua*, Forster."*

Several different species of trees which agree in having white, scented, night flowering blossoms, and somewhat similar foliage, are apt at first acquaintance to be confounded with each other. Indeed, all the flowers seen on the island, with the exception of Malvaceous plants, the *Dioclea*, and a minute small flowered convolvulus, were white or green.

On landing, the first plant encountered is almost sure to be the Ngashu (*Scaevola kaenigi*). This is a thickly growing shrub about eight feet high, with bare stems and terminal tufts of large fleshy leaves, among which are borne the inconspicuous white flowers and white berries. The wood is very soft, hollow, with a white central pith like elder. These plants love to grow at the very margin of the sea. The pith is said to have been used for caulking the seams of canoes.

Some of the most sterile tracts in Funafuti, of decaying coral washed by high tides, were densely overgrown by the Ngia or Ingia bush, for the botanical name of which, *Pemphis acidula*, Forst., I am indebted to Mr. E. Bêche, who made the acquaintance of this plant in the Marshall Islands. To whites it is known as ironwood, and is valued as furnishing the best firewood on the island. The natives carve the hard wood into various implements, and in former times weapons. The Ngia has small white flowers, narrow linear leaves, stem and branches like an overgrown heath, and attains a height of six or seven feet. Its general aspect reminded me of the "Manuka" of New Zealand, also a gregarious shrub delighting in the worst of soils. To this widespread species, a characteristic of atoll floras, evidently refer

* Seemann—*loc. cit.*, p. 251.

Cooper's* notes of "Nangiia" on San Bernardo and Palmerston Islands.

Besides the Fetau already described, there are two other blossoms especially valued for their scent by the natives, the Boua and the Jiali. In "the old times" flowers were worn lavishly, and are interwoven with many native tales and customs. A lover's wishes were granted by the lady of his choice, who crowned him with a scented garland, but a refusal was conveyed by handing to the less fortunate swain an unscented wreath. The passion for scent among the Polynesians was illustrated by the Hawaiian chiefs, who reserved the choicest scent trees for themselves by tabuing them to the common people.

The Boua (*Guettarda speciosa*, Linn.), grows abundantly as a small tree twenty feet high, with large, ovate, opposite, rough leaves, bearing in cymes a profusion of richly perfumed white flowers, with long slender corolla tubes. The leaves are used for poultices, and the flowers are employed both for scenting the anointing coconut oil and are worn as wreaths.†

The Jiali, determined by the kind help of Mr. R. T. Baker as *Gardenia taitensis*, D.C., is not so common, I noticed it only at Luamanif. It grows into a small tree, with glossy, opposite, obovate leaves, and bears large, handsome, white, sweet smelling, hypocrateriform flowers, which are used in the same way as the Boua. "A singular enchantment was employed [in the Hervey Group] to kill off the husband of a pretty woman desired by someone else. The expanded flower of a *Gardenia* was stuck upright—a very difficult performance—in a cup (*i.e.* half a large coconut shell) of water. A "prayer" was then offered for the husband's speedy death, the sorcerer earnestly watching the flower. Should it fall the incantation was successful."‡ For a married Mangaian man to dream of *Gardenia* meant, if the blossom were expanded, that he was about to become the father of a boy, if unexpanded, of a girl. The *Gardenia* blossom (the flower of flowers in native estimation) was, and still is, worn in the pierced ears of both sexes.§ In Tonga the same plant apparently had the same name and use, for a verse in an old song ran:

* Cooper—Coral Lands of the Pacific, ii., 1880, p. 76. "On Palmerston Island Damana timber is very plentiful, and so is a wood called Nangiia, generally found in the Pacific on desert shores, or on the brink of lagoons where its roots are bathed by the tide. Its characteristics are great weight, intense hardness, and closeness of grain. Mr. Sterndale considers that it would be very valuable as a substitute for boxwood for engravers. The logs were about 18 in. in diameter."

† The Vitians make necklaces (taube or salusalu) of the corollas of this and other white odoriferous Monopetalæ." Seemann—*loc. cit.*, p. 131.

‡ Gill—The South Pacific and New Guinea, Sydney, 1892, p. 22.

§ Gill—Proc. Austr. Assoc. Adv. Sci. for 1892 (1893), p. 613.

"We will plait thick wreaths of *jiale* for our heads, and prepare strings of *hooni* for our necks, that their whiteness may show off the colour of our skins;"* and we read that "sweet scented plants, principally the *jiale*," were planted before the grave of the Tongan king.†

Near the town were a few *Crinum* plants, whose flowers were woven by the girls into wreaths. They seemed to me to have been planted there, but the natives assured me that the species was indigenous, which I am more inclined to believe after reading that Woodford remarked it in the Gilberts.‡

Thespesia populnea, Soland., known both to the Ellice Islanders and Tahitians by the name of Miro,§ grew on the embankments between the cultivated swamps, I saw none undoubtedly wild. It is chiefly valued for producing the long, straight poles used in bonito fly fishing. The handsome dark wood I saw carved into a native drum.||

The Tausoun (*Tournefortia argentea*, Linn.) grows upon sandy soil and flourishes upon the leeward islands, where it gives its name to one locality. It appears as a low, round-topped tree with rough bark, dense foliage, and large dense cymes of small purple flowers. The large, obovate silky leaves attract a visitor's attention. No use is made of the soft wood, but the leaves are applied as a styptic to incised wounds; they are also collected to enrich the soil of the Taro plantations.

A bush, Valla valla (*Premna taitensis*, Schauer), grows abundantly on sandy ground, the large, thin, light green leaves of which emit an agreeable scent when crushed in the hand. These are used by the natives to scent coconut oil. When matches were unknown, the usual material for raising fire was Valla valla wood, a pencil being ploughed in a groove till friction produced ignition. At Nukulailai cauterisation was practised by applying a piece of Valla valla bark glowing from the fire to the seat of the pain.¶ I was told on this island that the root of this shrub was sometimes used as a dye. "The natives of Fiji, who call the tree 'Yaro,' employ the wood for house building."**

* Mariner—Tonga, i., 1817, p. 308.

† Mariner—*loc. cit.*, p. 409.

‡ Woodford—*loc. cit.*, p. 346.

§ Guppy—Trans. Vict. Inst., 1896.

|| "The natives in Fiji do not seem to make any use of the fibre of the Mulomulo (*T. p.*) so frequently used in other countries for cordage, but bestow great praise on the tree on account of the almost indestructible nature of the wood whilst under water. In Tahiti the tree was formerly regarded as sacred and planted on the 'Marae.'" Seemann—*loc. cit.*, p. 19.

¶ Mariner tells us that the Tongans applied ignited tappa to cases of hard indolent tumours.—*Loc. cit.*, p. 261.

** Seemann—*loc. cit.*, p. 187.

The favourite dye wood of Funafuti is the Nonou* (*Morinda citrifolia*, Linn.), a shrub growing plentifully wherever soil and shelter could be found. A height of ten or twelve feet is reached by this as a weak, straggling shrub, whose leaves are opposite, ovate-acuminate, large and glossy. The peculiar green fruit, an inch or two in length, somewhat resembles a green strawberry or a small, immature pine cone. The terminal twigs are four square. By the natives the fruit is eaten† medicinally, but they chiefly value the plant as a dye producer. A bright crimson-vermilion stain results from grating the bark of the root with a piece of rough coral and applying lime thereto. The native kilt or titi is thus coloured,‡ and the red strands in mat patterns similarly produced. Where the natives have more communication with Europeans the Nonou dye is discarded for aniline dyes. At Tonga, Mariner observed the Pandanus leaf, "first soaked for six or eight hours in lime water, and afterwards in an infusion of the root of the nono, where it remains for about a week; it is afterwards exposed to the sun, and becomes of a bright red; the root of the nono is of a dark bright yellow, which, upon the action of lime water becomes red."§

Once only was a *Cordyline*, probably *C. terminalis*, seen; upon the north-eastern islet I saw a few plants of this genus about three or four feet high, without flower or fruit. A native guide to whom it was pointed out called it Ti, a name by which it is known from Hawaii to New Zealand; he added that the root was "allee same sugar." Two species of *Cordyline* are cultivated in Fiji, where their roots are eaten by the natives.||

A rampant climber, smothering shrubs and young palms in its embrace, is the Sageta, a "vine" which Mr. E. Betcher has kindly identified for me as *Dioclea violacea*, Mart. The large, purple, papilionaceous blossom is succeeded by a broad pod three inches long and an inch wide, along the flat side of which runs a raised ridge or keel. English residents of the Ellice assure me that the

*The island in the Tokolau Group, Nukunonou, seems to have taken its name from this plant.

†"The Queensland Aborigines are said by Thozet to be very fond of the bitter-flavoured granulated fruit." Maiden—Useful Native Plants, 1889, p. 45.

"The fruit though rather insipid is eaten either raw or after undergoing some kind of cooking in Fiji." Seemann—loc. cit., p. 129.

"The natives of the Shortland Islands informed me that the neighbouring people of Rubiana were accustomed to eat the fruits of the common littoral tree *Morinda citrifolia* (urati), but that they themselves did not eat it." Guppy—Solomon Islands, 1887, p. 89.

‡It was doubtless with this not with "red ochre" that the dress presented to Capt. Moresby (New Guinea, p. 79) on Niutao was coloured.

§ Mariner—loc. cit., p. 209.

|| Seemann—loc. cit., p. 311.

bean of this plant is excellent eating, as indeed its botanical affinities would suggest. Yet as a source of food it is entirely neglected by a race whose diet is almost limited to the two staples of fish and coconut. As I have elsewhere remarked,* "we must remember that even among the most degraded races everything eatable is not eaten. As famine presses heavier upon a tribe so are coarser and less agreeable foods used." Dr. Guppy also points out "the singular fact that the inhabitants of one Pacific group are often unacquainted with, or make but little use of, sources of vegetable food which in other groups afford a staple diet."† I gathered from one source that the Sageta was used to caulk the seams of canoes, but I do not know exactly how it was applied. In general the natives described it to me as but a weed, and the only use to which they put it is to crop the foliage for green-soiling the gardens.

A common herb everywhere was the Tulla tulla (*Triumfetta procumbens*, Forst.), whose prostrate stems trailed for several feet over the ground. In sunshine only did the golden yellow petals unfold, but the burr-like seeds attracted attention in all weathers. This was the most valued medicinal plant for the native doctors, who made of its foliage both decoctions and poultices. The native pharmacopeia included several other plants, as the Talla talla gemoa (*Psilotum triquetrum*, Linn.); wounds from the spine of the *Monacanthus* fishes were treated with a poultice of this, and another mode of treatment was to pile the plant on a fire and hold the wounded limb in the smoke then produced. For ear ache a remedy was sought in the cruciferous herb Lou (*Cardamine sarmentosa*, Forst.), the leaves of which being chewed the juice is strained in a cloth and poured into the ear. "In New Caledonia this species is eaten instead of Cress and as an antiscorbutic."‡ A cure for boils is a poultice of the leaves of the Lakoumonong, kindly identified for me by Mr. R. T. Baker, as *Wedelia strigulosa*, D.C., a tall composite herb with yellow flowers, which grew among the *Broussonetia* bushes and reached a height of about six feet. It was further used as a scent plant. The leaves are chopped fine, wrapped in a cloth and strained by twisting, cloth and leaves are then soaked in coconut oil to impart to it a perfume.

Another scent was given to the anointing oil by crushing in it the fronds of Meili (*Polypodium*, sp.), a common fern there. Several other species of ferns flourished in shady places in the centre of the island, the most conspicuous of which were the large tufts of *Asplenium nidus*, Linn.

* In J. P. Thomson—British New Guinea, 1892, p. 283.

† Guppy—*loc. cit.*, p. 90.

‡ Seemann—*loc. cit.*, p. 5.

An *Abutilon* grew as a small shrub with handsome orange-brown blossoms in dry sunny places. On the north-eastern islet I once noticed an *Ipomoea* trailing over the ground. It resembled in habit but differed in leaf from *I. biloba*, Forsk. ; neither flower nor fruit was seen. No parasites or epiphytes were noticed with the exception of a *Cuscuta*, which entangled low bushes in its skeins of thread. The introduced couch grass, *Cynodon dactylon*, had obtained a footing around the village. Another grass grew thickly in small patches of swampy flats clear of trees. Two species of mosses occurred, one probably *Octoblepharum smaragdinum*,* Mitten, wrapped around the butts of the palms as a soft green mantle a handsbreadth deep.

The fallen trunks of trees were encrusted by a fungus, possibly a species of *Polyporus*.

A specimen of *Azolla rubra*, floating in the men's bathing pool, was the only instance of aquatic vegetation that came under my notice.

A log came ashore upon the windward reef, which an experienced bushman of our party having split and chewed, determined by its grain and taste to be New Zealand kauri, *Dammara australis*, Lamb. "An occasional log drifts to the shores, and at some of the more isolated atolls, where the natives are ignorant of any land but the spot they inhabit, they are deemed direct gifts from a propitiated deity. These drift logs were noticed by Kotzebue at the Marshall Islands, and he remarked also that they often brought stones in their roots. Similar facts have been observed at the Gilbert Group, and also at Enderby's Island, and many other coral islands in the Pacific."†

SUMMARY.

My observations on the Funafuti plants used by the islanders are far from exhaustive. A thorough inquiry into such a subject can only be undertaken with success by one speaking the language fluently. Medicine and magic are too intimately associated to be lightly discussed by a native herbalist, even in the present stage of civilisation. I could not attempt to unravel the sources of information, but some ideas at least of the virtues of plants are recent importations from Fiji or Samoa.

The above notes may thus be briefly classified : Food plants—*Cocos*, *Pandanus*, *Ficus*, and *Cordyline* ; Fibre—*Cocos*, *Pandanus*, *Ficus*, *Hibiscus*, and *Broussonetia* ; Timber—*Hernandia*, *Ochrosia*, *Thespesia*, *Rhizophora*, and *Pemphis* ; Dye—*Premna*, *Morinda*, and *Rhizophora* ; Scent—*Calophyllum*, *Guettarda*,

* Mitten—Challenger Reports, Bot., ii., p. 254.

† Dana—loc. cit., p. 287.

Premna, *Gardenia*, *Crinum*, *Wedelia*, and *Polypodium*; Medicinal—*Triumfetta*, *Tournefortia*, *Morinda*, *Premna*, *Psilotum*, *Cardamine*, and *Wedelia*. Neglected by the islanders as food are the seeds of *Pandanus*, eaten in Australia; of *Ochrosia*, eaten in the Solomons; of *Rhizophora*, eaten in Papua; and of *Dioclea*, eaten by Europeans.

POPULATION.

Louis Becke, author of those charming and vivid South Sea stories, "By Reef and Palm," and who once resided upon Funafuti writes,* "sixty or seventy years ago, so the American whale-ship captains of those days said, there were 3,000 people in the thirty and odd islets. Then, for the next thirty years, unknown and terrible diseases, introduced by the white men, ravaged not Funafuti alone, but the whole group, and where there were once thousands only hundreds could be counted; and until about 1860 it looked as if the total extinction of the whole race was but a matter of another decade. But, fortunately, such was not the case. In 1870 the writer counted one hundred and sixty people; in 1882 they had increased to nearly two hundred."

At the time of our visit (May - August, 1896) the census amounted to two hundred and fifty or sixty. Woodford† remarks upon a similar decrease in the Gilberts.

HISTORY.

"Seven of these islands or groups are probably Samoan in origin, with an admixture of Tongese. In some cases the Tongan was introduced at a late stage, in others the Tongan element was almost contemporaneous with the Samoan, but in all cases the Samoan preponderates so much as to have controlled the language. As far as I am able to judge from a comparison of the most familiar words, the Tokelau and the Ellice Island dialects have become practically assimilated to each other. Samoan largely prevails in the whole of the Tokelau and the Ellice Islands; it is the literary language, except in the Gilbert or Kingsmill Island colony of Nui, where the Gilbert Island dialect is spoken with a small admixture of Samoan or Ellice Island words and constructions."‡ Captain Wilkes in 1841 observed of Funafuti that: "It was soon found that they understood the Samoan language, and spoke a purely Polynesian dialect. The Samoan native easily conversed with them."§ Mr. John O'Brien tells me that he remarked

* Becke—*loc. cit.*

† Woodford—*loc. cit.*, p. 334. An exhaustive Report on the diminution of the native population of Fiji is, I understand, in course of publication by Dr. Corney.

‡ Newell, *loc. cit.*

§ Wilkes, *loc. cit.*

thirty or forty years ago that both the natives of Fotuna Island* and the Tokelau Group use the same dialect as the Ellice Islanders but a few words have different meanings.

"A most decisive proof of their history [the people of the Ellice Group] was recently obtained by Dr. G. A. Turner while visiting the missions of the group. He was shown, and he ultimately obtained, a spear or staff, which their orators held while speaking, a Samoan custom indicating the holder's right to speak; this staff was very ancient, and the greatest treasure of their heralds and genealogists; they said they brought it with them from Samoa, and named the valley where they came from thirty generations back. The staff was decayed or worm eaten, and bound together by splints and sinnet. Dr. Turner took it to Samoa, found that it was made of Samoan timber, visited the valley they named, and discovered a tradition there of a large party having gone to sea exploring, and never returning."†

The Samoans themselves look down upon the Ellice Islanders as rough, uncultured boors and would not acknowledge them as close relations. Their physical appearance, broad faces, large frames, hair often curly but sometimes straight, and short beards,‡ all support the conclusion drawn from the language and customs that a Micronesian element has here been grafted on a Polynesian stock.

Funafuti is, however, a most unfavourable locality for studying the relations of the Ellice Islanders. About thirty years ago most of the adult population were kidnapped by a Peruvian slaver recruiting labour for the Cincha Islands. The atoll has since received an immigrant population from various sources. Colonists from Samoa, the Tokelaus, Manihiki, and other of the Ellices settled in the depopulated village. There are two half caste families by white fathers and one by an American negro. Altogether there are not a dozen left of tattooed, white headed men and women who remember the Funafuti of forty years ago.

"Tradition says that the place was first inhabited by the porcupine fish, whose progeny became men and women. Another account traces the origin of the people to Samoa. It is said also that the islands were formed by a man who went about on the

* A comparison of the manners and customs of this island with those of the Ellice Group would be of much interest. I have not, however, met sufficient information relating to this French Possession to do so. Fotuna or Horn Island must not be confounded with Futuna near Tanna in the New Hebrides.

† W. L. Ranken—*Journ. Anthropol. Inst.*, vi., 1877, p. 233. See also Whitmee—*Journ. Anthropol. Inst.*, viii., 1879, p. 271.

‡ For characteristic figures of Funafuti natives of the pre-Christian time, see Wilkes—*Amer. Explor. Exped.*, v., 1845, pp. 40 and 41.

ocean with a basket of sand on his back, and wherever some ran out an island sprang up.”* Under a slightly different guise the latter version of the genesis was repeated at Niutao.

A native tradition related to me names the Kaounga as the first inhabitants of Funafuti and tells that they swam from Samoa. According to Newell a similar legend prevailed in Vaitupu. Among the Kaounga were the chiefs Toa, Touriki and Moroti, the names of the two former are still perpetuated by the localities in Funafuti called after them. According to Newell, “The people are descended from Samoans, known to posterity as Lafai, Le Fe’e (cuttlefish), Sa Seve (the clan of Seve), and two others, five clans in all.”

The following account of the ruling dynasty was given to me, through the interpretation of Mr. O’Brien, by the present king of Funafuti. Terematusa, he said, was the first king of Funafuti; he was succeeded by his eldest son, Kisosunga; and he by his eldest son Tiro, and he by his son Tiro the Second. A system long prevailed on the island of government by a king and subordinate chief. The latter succeeding to the supreme office on the death of the former and being succeeded in the subordinate position by the late king’s son.

“The so-called king of Fakaofo bears the title of “*ariki*” (Samoan, *alii* = chief), and is the only person until quite recently so described. The “*ariki*” is always the oldest male member of the four principal families of Fakaofo, all of whom trace their descent from the two brothers above referred to—namely Kava and Pi’o. When the “*ariki*” dies the oldest man then living among these four families becomes “*ariki*.” No others possess this title, and there are no clan names or titles outside this circle. The Samoan custom of conferring the name of the head of the family upon the heir does not exist in the Tokelaus.”† An arrangement resembling this seems latterly to have prevailed in Funafuti. Turner says of Funafuti,‡ “The kingship alternated in four or five leading families, and when one king died, another was chosen by the family next in turn.” Whitmee says of Niutao§ “the king and chief have sole authority on the island. Although the king has the higher title, he pays great deference to the chief, and they live on excellent terms with each other.”

Now Tiro the Second and Tibouro were kings together. And Tibouro was killed by his brother Ningi, who assumed the kingship but was killed by a spirit a fortnight afterwards. Takamiti succeeded Ningi. The next king was Palou, the son of Tibouro, who was followed by Touassa. In Touassa’s reign the land was

* Turner—*loc. cit.*

† Newell—*loc. cit.*

‡ *Loc. cit.*, p. 282.

§ Whitmee—*loc. cit.*, p. 22.

first portioned out, every individual receiving a share. But after Touassa's death, Erivada the priest instituted a redistribution in which the adult males or fighting men alone participated. The conflicting land titles granted by Touassa and Erivada breed dispute to this day.

Touassa's son Sirimiou succeeded him and was in turn succeeded by his son Jira, who was followed by his son Sikamani. Tarafo, another grandson of Touassa next ruled Funafuti; followed first by his son Taturi and then by his brother Teriki, who was reigning when Mr. O'Brien arrived on the island about forty years ago. The next king was Matavai his cousin, followed by the latter's eldest son, Yakoba (Jacob), in whose reign the people adopted Christianity. Manu his brother succeeded and was followed by the reigning king.

Another native gave me a story of the Tongan invaders who harassed the Ellice in bygone times. The marauders sailed from Tonga in two or three war canoes,* each holding a hundred men, and were accustomed to make the circuit of the entire Archipelago landing at each atoll and massacring the people. Their object was not head hunting or to procure the means of a cannibal feast, but merely slaughter to indulge their lust for bloodshed. On their return south they habitually carried with them a boy captive to Tonga, to serve, when he grew to manhood, as a reminder that the northern islands were ripe for another foray. When it is considered that these feats of navigation were performed without sextant or compass, and with but the rudest of charts, they may well be held to eclipse the boasted deeds of the mediæval Venetians, Genoese, or Portuguese, and to rival alone in daring or in seamanship the voyages of Scandinavian vikings.

Borouselif, the son of Toua and grandson of another Toua, the latter of whom was killed by the Tongans, was a great warrior. He drove back several of the Tongan incursions and slew many Tongans, including Tinaman,† a celebrated Tongan warrior, but was at last slain in battle by the Tongans. The last Tongan invasion, which occurred before the grandfather of my informant was born, is represented as having been repulsed with much slaughter. A spot in the reef is still pointed out where a fugitive was speared while swimming back to his vessel.

The Rev. J. E. Newell thus writes‡ of the neighbouring atoll of Nukufetau: "A full and explicit account is given here of a Tongan invasion. Unfortunately I could get no clue as to the probable date of that invasion and the war which ensued. Two

* For a description of one of these vessels, see Cook's Second Voyage, ii., 1777, p. 17.

† Probably the Tinaimanu of the Nukufetau legend.

‡ Newell—*loc. cit.*, p. 608.

large war canoes were sighted, and with one of them, the warrior of Nukufetau, named Laupapa (evidently a Samoan name), was speedily in contact. After a parley a battle took place in which two Tongan "chiefs" named Savea and Tinaimanu were engaged. Tinaimanu is referred to as the breeder of wars in the "Eight Islands"—i.e., the Ellice Group. The Tongans were driven off and went to Funafuti. There one of the Tongan chiefs (it is not clear whether this was Tinaimanu or not) established himself, but Savea and his people returned to Tonga. The chief who remained at Funafuti very quickly acquired a reputation for savagery. He practised cannibalism to such an extent that very shortly there were none but women and children left. Ten young boys, who were attached to the chief as his servants, when they grew up, formed a plot to murder the cannibal, which they successfully accomplished, thus ridding the Eight Islands of a scourge. . . . At Fakaofu, too, I heard that they had a tradition (which I could not obtain) of a war which had, hundreds of years ago, been waged between the Tokelau Islanders and the Tongans."

In the early days of the present king (say forty or fifty years ago), a feud existed between Funafuti and Nukulailai. To avenge the starvation of some Funafuti travellers on Nukulailai, a war party from the former island sailed across to Nukulailai and killed many men.

The Funafuti natives have long ceased to make or use any weapons,* but to resist the Tongans spears were fashioned of split palm tipped with shark's teeth. A shark toothed sabre, like that made in the Gilbert Islands, was called "kei," another with a bristling knob of sharks' teeth was "kekana." An aged, white haired and tattooed man, made for me models of a war missile, "tiapa," and a club, "lakoutoua," also a slender unarmed spear, as formerly used by his people.

In the canoes which put off from Funafuti to the "Peacock," "Their spears were only poles of coconut wood, pointed at one end; and their knives made of small shark's teeth, inserted into a stick with gum and fine sennit, and are about a foot long.†

"Clubs and great double-edged wooden swords, fifteen feet long, and edged with sharks' teeth, were kept in the larger temples for display on festive occasions in honour of the gods, and taken occasionally to the rocks at the landing-place to flourish about and frighten away any party from a ship, or from another island attempting to land"‡ at Nanomana.

* Whitmee wrote in 1870 (*loc. cit.*, p. 27), "On some of the islands wars are unknown. An old man on Vaitupu brought me a hatchet made out of the back of a turtle, and I asked if it ever had been used in war. He replied that he had never heard of war on Vaitupu."

† Wilkes—*loc. cit.*

‡ Turner—*loc. cit.*, p. 290.

In some of the Northern Atolls the natives were adepts at singlestick and wrestling. Some of these men showed me a variety of adroit tricks, whereby an unarmed man might safely seize a knife from his enemy's hand, break down his guard, or trip him. This skill at fence was taught them by the Gilbert Islanders.

A British Protectorate was proclaimed over the Ellice Group in Sept., 1892, by Captain Gibson of H.M.S. "Curaçoa."

HEATHEN WORSHIP.

To-day Paganism claims not a single adherent throughout the Archipelago. Christianity has now been embraced for a quarter of a century, and the memory of the old rites is rapidly vanishing. In a few years the knowledge of these that might still be gleaned will have become extinct. I have therefore added to my own gatherings a digest of information relating to the Ellice previously published. The religious customs of this Group, no doubt, were closely approximated to those of the Tokelaus described by Turner.*

On the subject of heathen worship, and indeed upon Funafuti lore in general, I owe most of the information gathered to the unwearied kindness of Mr. John O'Brien, who during forty years' residence has acquired a greater knowledge of native manners and customs than the younger generation of natives possesses. Mr. O'Brien kindly supplemented his recollections by questioning and interpreting from aged men on my behalf.

The first objects to which worship was addressed seem to have been Thunder and Lightning. A spirit, Tufokoula, was worshipped in the form of a sea bird. The Areva or cuckoo (*Urodynamis taitensis*, Sparrm.) was sacred on Nanomana.† For the interesting superstition regarding this bird on the Gilberts, see a paper by Mr. A. J. North.‡ To this succeeded ancestor worship. Toa, one of the traditional "Kaounga," or first inhabitants, believed to have swum from Samoa, was one of the earliest deified. Erivada, son of Erikobai, a famous and powerful priest of the olden time, appears to have arranged the rites and deities. Firaifi,§ a former king and famous warrior, was introduced as an object of worship, and any distinguished tribesman was on his death added to the Funafuti pantheon. "They appear," remarks Newell, "to have had more elaborate religious rites than other

* Turner—*loc. cit.*, p. 267. † Gill—Jottings, p. 25.

‡ Proc. Linn. Soc. N.S.W. (2), ix., p. 585.

§ Turner writes (*loc. cit.*, p. 285) the name "Foilape," and adds that he was also one of the principal gods of Nukufetau. The reigning chief of Nukufetau when the "Peacock" visited the group bore his name. Newell says (*loc. cit.*), "Foilape was a man of enormous physical strength and a fearful despot. He had to flee for his life to Vaitupu, where he was honoured as a god, after he had been murdered as a despot."

islands in the group. The group of atolls seems to have been filled with sacred places and shrines."

Erivada related that in a dream he was instructed by seven* spirits to make a god of a red stone, obtained by diving in the passage, wrapped in pandanus leaves and placed in a case, "fe'ou," like (as O'Brien described it) a hen-coop. If anyone fell sick the stone was taken out and beseeched to relieve or cure the sufferer. Erivada also manufactured from coloured pandanus leaves and shells the sacred casket, "bourou," supposed to be worn like a hat by Firafi. O'Brien, on his arrival, saw a ceremony performed by the priest, or as he termed him the "devil-master," to induce the spirit to send abundance of fish. This consisted of the bourou being taken out of the temple and carried thrice around it, followed by a procession of men and women stripped naked for the occasion. "Foilape," writes Turner, "was the principal god, and they had a stone at his temple. There was an altar also on which offerings of food were laid. At the order of the priest the altar was carried about the settlement, and as the god was supposed to be on it, the people danced in front and all around to please him." On Nukufetau, "Occasionally, after a death for instance, the people assembled, and in honour of the god paraded about the settlement, carrying shoulder high the box containing his treasures."†

No fisher would use his catch till an offering was made to the temple. Receiving the first fruits of every haul, the priest would walk around the temple, and calling each of the numerous spirits by its name, would deposit upon post after post for each his fish in sacrifice. A barracouta was always appropriated by the temple, presenting this perquisite was called "greasing the mats of the temples."

Such valuables as fine mats or pearl shell fish-hooks were frequently offered. When any new or wonderful object was acquired, if for instance a bottle or tin came ashore, it was at once taken to the temple. In Nukufetau, Turner tells us‡ that "Any rare beads or other fancy articles from a ship were presented. If concealed, the god knew it, he was omniscient, and brought death on the culprit." At Fotuna, "It forms an important part of the religion of this island to consider everything that arrives there, whether of great or little value, as the property of the gods, no matter whether it be a large canoe or a log of wood."§

* Referring to this mystic number, Newell writes (*loc. cit.*) of the ransom for a child's life upon Nukufetau of seven bowls of faausi, "So far as I know this is the only instance of the number seven being considered the number of completeness, as in the Hebrew Scriptures."

† Turner—*loc. cit.*

‡ Turner—*loc. cit.*, p. 205.

§ Mariner—Tonga, i., 1817, p. 318.

Sometimes it would be announced by the sorcerer that a certain person was about to fall sick. The threatened victim then had to reside in the temple, and enchantments were pronounced over him twice a day; he was anointed with coconut oil, and was placed in the smoke of a fire so that the demon's eyes might be blinded and he escape.

A kind of divination was practised by spinning a coconut before the altar; if it came to rest in a particular position success was prophesied, but if the result was unpropitious the nut would be coaxed, fondled, and spun again. A similar divination by spinning a coconut is described by Mariner in Tonga.*

"A temple with a covering was known as a 'Fale-Atua,' a shrine was an 'Afu,' and the priest, as in the Tokelaus and in Samoa, was a 'Vakatua.' Long after the significance of the temple was forgotten the stone shrine or memorial was worshipped."† A beautiful illustration of the gods and temple of Fakaafu by a member of the first European party who visited that island of the Tokelau Group, faces p. 274 of Dana's Corals and Coral Islands, 1872.

The last temple on Funafuti was destroyed by the hands of Mr. O'Brien.

On this atoll the priests chose the sailing dates for canoes visiting other islands. If the vessel missed her destination, the drifting and starving crew used first to kill and eat the "devil-master."

Regarding heathen worship, the Rev. S. J. Whitmee writes‡ of the Ellice Group in general at the time when the Archipelago was passing from Paganism to Christianity:—"They worshipped the spirits of their ancestors; mostly those who originally peopled the islands, but some of later generations have been deified in some of the islands. They have shrines in some places where they offer their devotions, and where the gods come to hear their prayers and accept their offerings. Some have tangible representatives of their gods in the shape of stones;§ but as far as I could learn, they always had the idea of spiritual beings taking up their abode in them either for a time or permanently. They have also a number of sacred men through whom they communicate with their gods. In some of the southern islands, now Christianized, there was only one sacred man in each village. He was chosen by the people from one particular family. At

* Mariner—Tonga, ii., 1817, p. 239.

† Newell—*loc. cit.*

‡ Whitmee—*loc. cit.*, pp. 26, 27.

§ At the temple of Maumau on Nanomea, there stood a nine feet high coral sandstone slab from the beach. Turner—*loc. cit.*, p. 291.

his death, his successor was generally, but not necessarily, his brother or son. If one failed to satisfy the people, he was deposed and another chosen. This man was regarded as very holy. He dwelt with his family apart from the rest of the people. His house was generally built on piles over the shallow water in the lagoon. He never worked, but he and his family were fed by the community. He gained power over individuals and abundance of food, by promising the favour of the gods to those who treated him well, and denouncing their anger upon those who were niggardly and brought him little food. When the gods communicated with him he pretended to be possessed,* threw himself into all kinds of attitudes, raved, foamed at the mouth, and his eyes glared wildly. Then he pronounced the oracle to the people who had assembled around at a respectful distance. On two islands, the places where the houses of the priests stood were pointed out to me, and also the places where the people congregated. The distance between them could not have been less than two hundred yards. The priest performed incantations before the people went out to fish; and to the anger or favour of the gods the success or non-success of a fishing expedition was ascribed. On the northern islands there are several priests; they mix with the people, and seem to be far less exclusive than the single priest was on the southern islands."

"The natives of Niutao," writes Dr. Gill,† "were accustomed to worship their heathen deities in a marae in the centre of the village. Of this great marae only one stone is now left, representing Tangaloa, god of heaven and principal deity of Polynesia. . . . Only forty [Aug., 1872,] still adhered to their ancient faith, and these were easily distinguished by a single sacred leaf of the coconut worn on the left arm. . . . Half a mile distant in the bush is their ancient burial ground. Adjoining it is their pantheon, consisting of an oval, low enclosure, composed of flat stones, some higher than others, each representing a distinct divinity; so that the sacred men standing inside the enclosure—the people of course outside—could worship all the gods at once. . . . Returning to the village, we entered an idol-house. The god is the central side post, stouter than the rest and crooked. To the crooked post—utterly destitute of ornament—three green coconuts and a sacred leaflet were offered‡ morning and evening. On these occasions the worshipper (with

* "When the priest on Vaitupu became 'red,' by which they meant flushed and excited, it was a sign that the god had something to say." (Turner—*loc. cit.*, p. 284.) For a description of Tongan priests in religious frenzy, see Mariner—*loc. cit.*, p. 106.

† Gill—*loc. cit.*, p. 12.

‡ This act is illustrated by a woodcut in the text on p. 15.

whom we conversed) goes through his incantations, and, husking the nuts with a stick kept for the purpose, drinks the water and eats the kernel, and then puts newly-plucked nuts in their place. Each new act of worship necessitates the tying of a fresh leaf round the post, and another round the arm of the worshipper. Four old coconuts lay at the foot of this queer post god. In another idol house, we saw on a swinging tray, a smooth round pebble worshipped as a god. Offerings of green coconuts lay near it, with the sacred leaflet."

Of the same island, Niutao, Moresby observed:* "Native missionaries have been two years at work here, but half the people are as yet devil worshippers, and adore the evil spirit under the form of coconut leaves, skip jacks, and wooden posts. Every heathen family has a small devil hut, in which a tiny grass hammock is slung for the evil spirit to sleep in, and where offerings of fresh nuts are brought him every morning; many of these huts were in full use, but we were pleased to find others forsaken."

Turner informs† us that "Kulu was the principal god in Niutao, and at the evening meal was prayed to for rain, coconuts, fish, freedom from disease, &c. Offerings to Kulu were eaten only by the priest, or by any *stranger* to whom he might hand a share."

The same author says of Nanomana,‡ "Foelangi and Maumau were the principal gods. They had each a temple; and under the altars, on which were laid out in rows the skulls of departed chiefs and people,§ were suspended offerings of pearl shell and other valuables. Foelangi had an unchiseled block of stone to represent him, something like a six feet high gravestone. The household gods were incarnate in the fish. Offerings of food were taken to the temples, that the gods might first partake before anyone else ate anything. While visiting one of these temples I saw a number of fresh plucked and husked coconuts laid down, one before each skull. After a time the nuts were taken away and eaten by the family who laid them there. Clubs and great double edged wooden swords, fifteen feet long, and edged with sharks' teeth, were kept in the larger temples for display on festive occasions in honour of the gods, and taken occasionally to the rocks at the landing place to flourish about and frighten away any party from a ship or from another island attempting to land, until at least special permission from the

* Moresby—New Guinea, 1876, p. 78.

† Turner—Samoa, 1884, p. 288.

‡ Turner—*op. cit.*, p. 289.

§ In Nanomana "On a 'paata' (= shelf) were laid human skulls and jawbones."—Dr. Gill's MS. Diary.

gods had been asked." The destruction of these temples by Christian converts in 1877 is related by Dr. Gill.*

Upon Nanomana Dr. Gill remarked to a native: "'Jehovah made the sky, the ocean, and all men.' The prompt reply was, 'Very likely Jehovah made *you* and *your* land; but the good gods Maumau and Foelangi' (their ancestors who came from Samoa) 'made us and Nanomanga.' They worship shooting stars and rainbows; but the principal objects of adoration are the skulls and jawbones of the dead. Crowds of men ran to the beach to meet us, besmeared with ashes mixed with oil, each wearing the sacred leaflet on the left arm, with necklaces of flowers. In this costume they had been dancing and performing their wild incantations to the gods during the night. The response of the oracle was, that no foreign god or instructor should dwell on the land sacred to Maumau and Foilangi. In one of these temples on a large swing tray we counted eleven human skulls; on another tray, nine. It was to accommodate these skulls that the temples were built. It is the disgusting custom in Nanomanga, when a great chief or much loved head of a family dies, to bury the corpse, but on the third day, the head is removed, and the flesh gnawed off and eaten raw with coconut by the sacred men.† The clean skull with the jawbone are then put on a tray in the appropriate temple, and thenceforth become objects of worship. I called on King Atupa. He was reclining on a mat, with an ominous cough, and seemingly far gone in consumption. We were told that on his death his skull would be added to the tray of gods in the adjoining temple."‡

"In Ellice's Group skulls of head chiefs are hung up in houses and taken down periodically, and oiled during the weeping and wailing of women. I was present at one such ceremony. At some islands the women not only weep, but beat their eyes from time to time with their fingers, until the eyelids are so swollen as to render it necessary to keep in the house for some days."§

An extraordinary species of quarantine is thus described by Mr. Whitmee|| at Nanomea: "At this island and at Nanomanga there are some singular heathen ceremonies gone through on the arrival of a ship or a canoe from another island. As these ceremonies occupy from six to eight hours, the whole of which is spent in a burning sun, and the ceremonies are not of the most pleasant nature, I was desirous of escaping their infliction if

* Gill—*loc. cit.*, p. 24.

† "By the teeth of children," according to Turner—*loc. cit.*, p. 289.

‡ Gill—*loc. cit.*, p. 21.

§ (? Gill in) Davis—*Anthrop. Rev.*, vii., p. 192.

|| Whitmee—*loc. cit.*, p. 24.

possible. . . . The four new arrivals were marched to the place where the representatives of their gods were, and there a number of prayers were offered by the priests. These were to deprecate the wrath of the gods on account of the arrival of a foreign ship, and especially this ship of the foreigner's God. They also prayed that no disease might be brought by the ship to their island; but if disease was on board that it might be taken to Fiji. And as they are suffering at the present time from drought, they also prayed the gods to send them plenty of rain, and plenty of food. These prayers were repeated at the shrines of the different gods (and they seem to be very numerous), and were followed by an offering of a large quantity of coconuts, which the people themselves eat after they have been presented to the gods. Then they marched around the gods in single file, and marched around the strangers, and afterwards joined in a dance. . . . I was told by Tavita there was no fear of a repetition of the previous days ceremonies, as they were vicarious, and gave all on board the freedom of the island while our ship remained. Had any other vessel arrived while we were there, those on board of her would have been free also, but for one arriving after we were out of sight the ceremonies must be repeated."

In describing the same rite, Turner says:* "Meat offerings were also laid on the altars, accompanied by songs and dances in honour of the god. While these ceremonies were going on all the population, except the priests and their attendants, kept out of sight."

Gill writes† of Nanomana under date August 13, 1872: "We were the first visitors fortunate enough to escape being 'devilled' whilst the heathen performed incantations to prevent the introduction of disease."‡

BURIAL.

As in New Guinea the dead are buried in the village streets near the houses of their relatives. A few small cemeteries, or groups of a dozen graves, occur besides close to the village. Whitmee's description is as correct of the Funafuti fashion of to-day as it was at the time of his visit. "Their dead are interred in the earth, and their graves are surrounded by a border of large stones with a covering of small pieces of broken coral in the middle. These are generally very carefully kept in order. In the case of a chief, a mound is raised for two to four feet high over the grave, and all around is kept free from weeds."§

* Turner—*loc. cit.* p. 292.

† Gill—*loc. cit.*, p. 19.

‡ Admiral Moresby has described a like exorcism which he as a visitor underwent in the New Hebrides.—New Guinea, 1876, p. 102.

§ Whitmee—*loc. cit.*, p. 27.

On Vaitupu: "The dead were buried inside the houses, and in the grave they deposited with the body pearl-shell fish hooks, necklaces, and other ornaments."* In the Hervey Group: "If a body were buried in the earth, the face was invariably laid downwards, chin and knees meeting, and the limbs well secured with strongest sinnet cord. A thin covering of earth was laid over the corpse, and large heavy stones piled over the grave. The intention was to render it impossible for the dead to rise up and injure the living. The head of the buried corpse was always turned to the rising sun, in accordance with their ancient solar worship. It was customary to bury with the dead some article of value—a female would have a cloth-mallet laid by her side, whilst her husband would enjoin his friends to bury with him a favourite stone adze, or a beautiful white shell (*Ovula ovum*) worn by him in the dance. Such articles were never touched afterwards by the living."†

DOMESTIC LIFE.

The old order has changed to such an extent that it is difficult to gain information upon the former social system. The elder natives are averse to discussing what they now regard as the shameful and deplorable past. From tales and odd remarks I was however able to glean a little.

As usual among the Polynesians, sexual morality on Funafuti was of the laxest before the introduction of Christianity, and chastity was unknown. A wife belonged to her husband in so far as she shared his home, he supported her and he was entitled to the produce of her labour in cooking, weaving, fishing, gardening, and so forth, but he did not claim the exclusive right to her person. If a man desired the society of another's wife, he might throw a pebble into the hut as he walked past; the complaisant husband, accepting the signal, would then leave and allow the visitor to enter unmolested.

A marriage was celebrated by the presentation of coconuts and other trifling gifts. Where friends or relatives opposed a union, the couple would sleep in the bush, and stay away from the village till they were forgiven, much in the way that Pritchard describes runaway matches in Samoa.‡ Matriarchal rule prevailed over patriarchal; a bridegroom left his father's house to join his wife's family, sometimes two sisters and their husbands shared a hut. Dr. Gill writes of Nanomana: "Women here though married are common; but the children belong to the legal husband."§

* Turner—*loc. cit.*, p. 284.

† Gill—The South Pacific and New Guinea, 1892, p. 23.

‡ Pritchard—Polynesian Reminiscences, 1866, p. 136.

§ Dr. Gill's MS. Diary.

The usual sequence of such unrestricted intercourse, infanticide, was generally practised upon Funafuti. Indeed it was once obligatory to destroy each alternate child. Mr. O'Brien tells me that thirty or forty years ago, he knew women to enter the lagoon before the occurrence of birth, that the child might be immediately drowned. On Niutao, "the ancient rule was to rear only two children in each family. The life of the third might be redeemed; the rest were put to death as soon as born."* "On Nukufetau, as elsewhere, infanticide or foeticide was the law of the land. Only one—some say two—were allowed to live in each family, the rest were strangled. But it was possible for parents to ransom their offspring by giving a present to the chiefs."†

At times, to allow the coconuts to grow up and to give the fishing grounds a rest, the permanent village is temporarily abandoned, and the whole tribe move to another locality. Several duplicate villages are built about the lagoon, perfect sometimes even to the chapel and court house, wherein each family owns a residence, and to which they periodically move to enjoy a change of air and scene. Probably it was one of these temporary settlements which Moresby‡ saw at Funafuti, and mistook for a deserted village.

The permanent village consists of a score of huts arranged in a long straggling street parallel to the beach. This street has a hard beaten floor, which is kept swept and weeded with great care by the women, who devote fixed hours to this work. From the main street branch roads, which are metalled with shingle and curbed with blocks of coral. Wrong doers are punished, under the modern system, in imitation of colonial justice, by being set to repair these roads. An avenue of breadfruit trees casts a pleasant shade along the street, while around and above all tower the loftier coconut palms. Each hut is at least a dozen yards from its next door neighbour, and has its own kitchen situated some little distance away. Two or more married couples sometimes live together in a hut of about twelve by twenty feet. The floor is usually carpeted with large pandanus mats, but in the more pretentious stone dwellings the ground is covered with fine shingle.§ The roof, pitched in European style with

* Gill—Jottings from the Pacific, 1885, p. 27.

† Newell—Proc. Austr. Assoc. Adv. Sci., 1895 (1896), p. 609.

‡ Moresby—New Guinea, 1876, p. 74.

§ Until lately the caverns of Atiu and Mangaiia were despoiled of the finest stalactite columns, in order to adorn the premises of the chiefs by keeping the snow white sea pebbles in their place, much as at home we use ornamental tiles for gravelled walks. Anciently the maraes of their gods were thus adorned."—Gill—*loc. cit.*, p. 86. The graves in Funafuti were likewise gravelled.

ridge pole and rafters, is covered by an excellent thatch of pandanus leaves. Sometimes the walls are protected by the same, but more often are enclosed by palm mats swung on cords, which may be raised, lowered, or pushed aside at discretion, and doors or windows are thus formed anywhere at caprice directs.

All small articles, tools, garments, or fishing utensils are usually suspended from the roof or stuck in the thatch. By day the only furniture visible is the usual locked trade box in the corner, but by night the hut is partitioned off into numerous small chambers by the calico mosquito curtain of each single individual or married couple.

"A house after the usual Samoan fashion just described has but one apartment. It is the common parlour, dining room, &c., by day, and the bedroom of the whole family by night. They do not, however, altogether herd indiscriminately. If you peep into a Samoan house at midnight, you will see five or six low oblong tents pitched (or rather strung up) here and there throughout the house. They are made of native cloth, five feet high, and close all round down to the mat. They shut out the mosquitoes, and enclose a place some eight feet by five; and these said tent-looking places may be called the bedrooms of the family. Four or five mats laid loosely, the one on the top of the other, form the bed."*

The Papuan custom of avoiding mosquitoes by sleeping in the smoke seems unknown here. For further particulars about the mosquitoes, the reader is referred to Mr. Rainbow's article on the Entomology of Funafuti.

A European on entering is always requested to seat himself on a bunk or trade box, and is at once welcomed with a drinking coconut, opened and handed to him by a daughter of the house.

Artificial light was quite unknown upon Funafuti before the advent of the whites. Mr. O'Brien told me that to bring fire into a dwelling house was most strictly tabued; he described to me the astonishment of the natives when an early visitor improvised a rough lamp from a coconut shell bowl filled with coconut oil. On Niutao, "No fire was kindled at night lest it should prevent the gods from coming in a shadowy form with a message."† And on Fakaafu, in the Tokelau Group, Dr. Turner likewise tells us "No fire was allowed to be kindled at night in the houses of the people all the year round. It was sacred to the gods, and so, after sundown they sat and chatted in the dark."‡

* Turner—Samoa, 1884, p. 155.

† Turner—*loc. cit.*, p. 288.

‡ *Id.*—*Op. cit.*, p. 269.

No cooking is ever done in the house, but each family has a separate kitchen, a roughly built hut, some distance away from the dwelling. No native pottery exists, nor do the islanders seem to appreciate European earthenware, but iron pots are valued. Coconut shells are used to heat fluids. The usual Polynesian method of cooking with hot stones in a hole in the ground still prevails, it has been well described by the Rev. S. Ella,* as well as by numerous other writers. For lack of better stones the cooks are obliged to use coral, of which they select the hardest kinds, such as *Montipora* and *Millepora*, even these soon crumble in the fire. If any volcanic rock was brought as ship's ballast from Fiji or elsewhere, it was eagerly seized upon for cooking-stones. The roots of trees drifted ashore were also carefully searched for hard stones.

A missionary says: "Missionaries are by some charged with too great strictness in their dealings with the failings and weaknesses of recent converts. If those who make the charges took the trouble to enquire, they would find that missionaries generally take the opposite side, and endeavour to modify the severity of the converts themselves towards their erring brethren."† The severity of the Native Teacher towards the gentle, submissive Islanders, remarked upon by all the members of the Expedition, is probably, as indicated by the foregoing quotation, contrary to the wishes of his superiors. He seemed as anxious to obliterate native manners, and to substitute the habits and customs of the European, as he understood them, as to preach the European's creed. One instance of this that came under my notice was where children were scolded for indulging in the pretty native custom of wearing wreaths of flowers in their hair. In their progress towards civilisation the natives have lost most of their old amusements. The elders often look back with regret to the merry old days of heathendom, when the village was not so dull. Foot racing, lance throwing, quarterstaff fencing, wrestling, and dancing have died out under the Native Teacher's disapproval. Singing is still keenly enjoyed, but is only permitted under the supervision of the Native Teacher or Deacon, and in a subdued tone. Attention is directed rather to singing passages from the Scriptures, or the multiplication table set to verse than to the stirring native chants. A public meeting for singing takes place twice or thrice a week. The sexes sit apart, usually facing each other from opposite sides of the house; they both sit cross legged or tailor-wise. A leader on one side or the other usually strikes up, and the rest at once fall in. The old Funafuti airs which were danced to wild

* Aust. Assoc. Adv. Sci., 1892 (1893), p. 636.

† Whitmee—*loc. cit.*, p. 13.

and stirring music are now, I am told, entirely forgotten except by a few of the oldest inhabitants, yet Mr. O'Brien tells me they survive on Vaitupu still. On asking the interpreter for a translation of the song, I am answered that such a one is the story of Lot's wife being turned to salt, another is in praise of the Bible or composed of passages from the Scriptures, another subject is a battle between England and France; Captain Webb's feat of swimming across the Straits of Dover forms, oddly enough, the theme of yet another. All these songs are sung squatting on the ground, anyone attempting to rise is promptly suppressed by the Native Teacher. Appropriate gesticulation is given with hands and arms, paddles are swung, axes are lifted, guns are aimed, and strokes are swum in unison. Time is marked by incessant clapping of the hands, for variety the palm is occasionally slapped against the arm, the thigh, or upon the ground. As the fervour grows the music sinks and swells, time beats grow faster and faster till the words and notes cannot be more quickly repeated, and in a paroxysm of clapping a dead stop is reached by the breathless and perspiring chorus. Watching in the lamplight the soft, brown arms tossing with the cadence of the song, the waving hair, the gleaming teeth and glistening eyes of a score of handsome women, one can imagine to what a pitch of excitement the dances, the real dances of the olden time, roused this impressionable people. The music is simple, yet thrilling, and to most Europeans though attractive is singularly evanescent. I, for one, could never afterwards recall a tune however much I had enjoyed it. Hickson has noted a similar impression of savage music.* The natives on the other hand seem to find as much difficulty in catching European tunes as we do in recollecting theirs. An exception, however, I noted in "Ta-ra-ra Boom-de-ay," which was a favourite and correctly repeated air on Funafuti.

A popular song on Funafuti, an importation I believe from Samoa, runs as follows:—

E piu i se sevi lou manamea,
E i ai i le maunga o Peteri,
Ina ta tuu ia Lapanona,
La'u ava ina ta tuu.

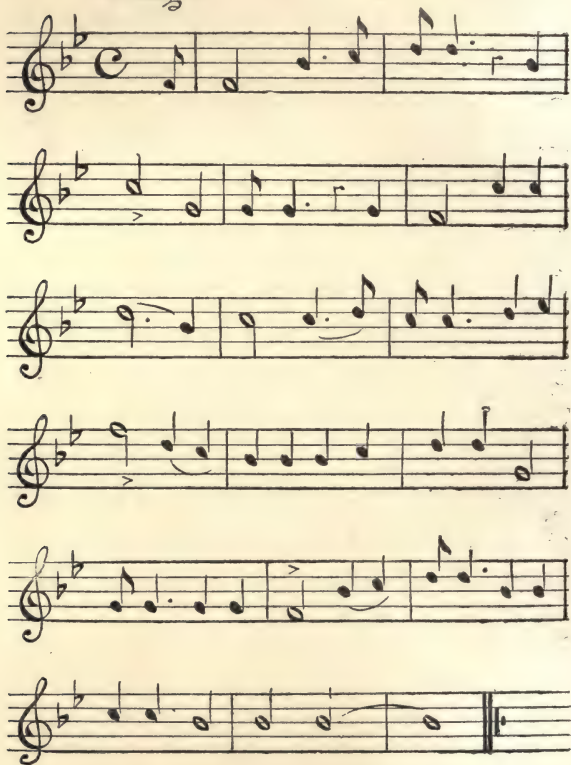
O loo silasila i faamalama
O loo pupula mai lona tino
Ina ta tuu, &c.

Internal evidence, reference to Lebanon, &c., show the words to be a modern composition, the tune is however probably older. I am indebted to the kindness and musical talent of my friend,

* Hickson—A Naturalist in North Celebes, 1889, p. 79.

Mr. H. Foden, R.N., Acting Paymaster of H.M.S. "Penguin,"
for the following air current on Funafuti :*—

Allegro.



The narrow bounds of habitable land has restricted the introduction of domestic animals. Pigs are owned by every family,

* But few of the native chants of Polynesia appear to have been reduced to writing. A Tongan tune is given by Mariner—Tonga, 1817, ii., p. 338; Samoan by Wilkes—*loc. cit.*, ii., pp. 152-3; and Melanesian by Guppy—*loc. cit.*, p. 140.

they are usually confined in sties and fed upon waste coconuts. No other Ungulates have been brought to the atoll.

Dogs were at one time domesticated, the manner of their extermination, told me upon Funafuti, is thus related by Moss: "At Funafuti the Turimen march round the village during the night, and quietly steal into the houses to see if all is right. It was found that the house dogs barked and gave notice of their approach, so they forthwith decreed the destruction of all dogs on the island and again became masters of the situation."* This little episode illustrates the severity of the Inquisition which the rule of converts imposes on Polynesia.

Cats have long been introduced, they are known to the natives by the name of "pussy," and have proved of service in destroying the brown rat, formerly a great pest to the Islands. The European rat and mouse have effected an uninvited entrance to the village, and have multiplied fast.

The Frigate-bird is tamed in the Ellice Group, and is said to have been used like carrier pigeons (*vide* Ornithology). None were kept at Funafuti during the visit of the Expedition, but I saw one in captivity at Nukulilai. On Niutao, "They are fond of taming the frigate-bird (*Atagen aquila*) or man-of-war bird. A high perch is built near the sea, and the bird secured to it by a long string. The native pastors on most of the islands—lying about sixty miles apart—of the Ellice Group, correspond with each other by means of the frigate-bird. The note is concealed in a bit of reed and tied to one of the wings. In the olden time pearl fish hooks were in this way sent from one island to another. Its long black feathers were formerly in great request for head dresses."† That this system of taming Frigate-birds prevailed beyond the Ellice and the Gilberts, where Woodford has remarked it, is suggested by an incident related by Webster. Landing in 1851 on Ocean Island or Paanopa, he says, "I was well nigh making an unlucky mistake; observing a number of large birds at a short distance, I raised my gun to fire at them, but was suddenly checked by my companions, who motioned me not to fire. They turned out to be tame fish hawks belonging to the king; but for what purpose I am at a loss to determine."‡ Moss also noticed these birds tamed on Pleasant Island.§ Probably the habit was a Micronesian custom received with the art of toddy making from the North. The natives of the Solomons delight in portraying this bird in their carvings. ||

* Through Atolls and Islands in the Great South Sea, 1889, p. 118.

† Gill—Jottings from the Pacific, 1885, p. 17.

‡ Webster—The last Cruise of the Wanderer, Sydney, n.d., p. 43.

§ Moss—*loc. cit.*, p. 187.

|| See Brencbley—Cruise of the Curaçoa, 1873, p. 260.

Fowls, of which there are abundance, complete the list of domesticated animals.

During the last ten years the Islanders have abandoned their native names, and call each other by Samoan forms of Scriptural names, as Salamona, Solomon ; Paulo, Paul ; Yakoba, Jacob, &c.

In former days incorrigible criminals were drowned by throwing them into the lagoon with a stone tied round the neck. A story was told me of a woman convicted of theft, who was exposed with her infant upon a distant, small islet, and allowed to slowly perish there. On Nanomana, "It is reported by the traders that if any one breaks their laws, he is sunk in the mud of the lagoon shore, out of which it is impossible to get, and there is miserably suffocated."* On Funafuti, and probably throughout the group, Mr. O'Brien told me that any condemned could claim sanctuary who could escape to the king's house. A similar practise prevailed in Samoa † Upon Nukulailai, "Stealing was punished by restoring double, adultery and murder by sending off the culprit to sea alone in a canoe, there to die or take his chance of drifting to some other island."‡ Mariner describes such an execution in Tonga, by drowning in a leaking canoe.§

Near the village, a quarter of a mile apart, were two small ponds about four feet deep, twenty or thirty long, and half as wide, containing foul green water. These were the public bathing places, one was reserved for men, the other for women. Clothes were also washed here. There were also several small circular wells with stone walls about six feet deep, above ground they were carefully fenced round with sticks. A pole to which an empty coconut shell was attached was always kept handy to bail water out with. Dr. Gill records a case where two Europeans so exasperated the inhabitants of Niutao by bathing in one such well that they were put to death.

CULTIVATION.

Landed property is here of three species ; the town allotment or stand of a hut in the village street, the bush land planted with coconuts, and the garden land. The culture of the coconut, pandanus, and paper mulberry has been noticed under the preceding section on Vegetation. The whole chain of islets is parcelled out, usually divided by lines running across from ocean to lagoon, which boundary lines are strictly preserved. Considerable disparity of wealth exists, some families owning as

* Dr. Gill's MS. Diary.

† Wilkes—*loc. cit.*, ii., p. 158.

‡ Turner—*loc. cit.*, p. 281.

§ Mariner—Tonga, i., 1817, p. 295.

many as forty blocks, others but a single piece of land. In the past overtures for selling or leasing the coconut lands to copra traders were steadfastly resisted by the natives, and under British rule the title is inalienably vested* in them. Parents sometimes divide their estate to provide for their married children. Lands pass by will on the owner's death; instances have occurred where relatives have been cut off with the proverbial shilling, and being left to starve have been supported by public charity.

A space of about ten or twelve acres south of the Mangrove Swamp is occupied by the gardens, which in former times, when the population was more numerous, covered a larger area. The gardens are in excavations six or eight feet deep, the object of excavation being to reach the level of permanent swamp. At Nukulailai, where I saw the cultivation ground being enlarged, the natives were digging down ten or twelve feet. The gardens are irregularly divided into blocks of a couple of acres or more by embankments, which represent the original level of the land, and are three or four yards in breadth. These serve as paths, and are usually planted with *Artocarpus*, *Thespesia*, or *Hibiscus*.

Each family has at least one plot of garden land, and most have more, a plot may be as small as ten paces square. The plots of one owner are not necessarily contiguous, nor are the lands of various owners divided from each other by any boundary visible to a stranger.

The wooden shovel or turtle shell hoe of the past is now replaced by metal bladed spades, and these are their only agricultural implement. Like all semi-civilised people the Ellice Islanders keep their gardens beautifully free from weeds. An analysis of the soil from one of their gardens by my colleague, Dr. Cooksey, follows in another Section. The appearance of phosphate of lime I am unable to account for. The only system of manuring I observed was that of twisting palm leaves in a wreath, and laying them around the roots of the brokka, in a basin thus made were buried basketfuls of leaves of various bush trees gathered by the women.†

The staple vegetable food of the Funafuti Islanders is furnished by the *Alocasia indica*, Schott, known to them as "brokka."‡ It is said to require from six to eight years to reach maturity,

* By Proclamation in The Fiji Royal Gazette, 5th Sept., 1894.

† Cultivation on Funafuti is also described by Whitmee—A Missionary Cruise, 1871, p. 12.

‡ In the Hervey Islands (Gill—The South Pacific and New Guinea, 1892, p. 10) it is called "kape." Some writers refer to it as Puraka. Guppy (Trans. Vic. Inst., 1896) quotes numerous other names from the Pacific and Indian Ocean.

when the leaves attain a height of twelve or fifteen feet, and the flower stalk six or seven, the root, a greater load than a man can carry, is then about four feet long and twenty inches in diameter. As the plant grows the root is "hilled up" to two or three feet. It is generally harvested about a year after planting, before it has attained the full size. The tuber is hard and unpalatable to Europeans, when cooked it looked to me like brown soap. The Islanders preserve it cooked and packed in coconut shells. At the time of our visit a quantity of brokka so prepared was collected to send to a Native Teacher on one of the Gilbert Islands where a famine was then occurring. Dr. Seemann thus describes this plant in Fiji: "The *Via Mila*, always growing in swamps, is a gigantic species, often twelve feet high, the trunk or corm of which—the edible part—is when fully developed, as large as a man's leg, a single leaf weighing three and a half pounds. The petiole was found to be four feet long, and ten inches in circumference at the base; the blade of the leaf three feet two inches long, two feet six inches broad, and thirteen feet six inches in circumference. The plant emits a nauseous smell, amply warning, as well as the various popular names it bears, against any incautious contact with it. Besides the name of *Via mila*, which signifies "acid *Via*," we have that of *Via gaga* or poisonous *Via*. What may be the meaning of *Via seri* and *Dranu*, occasionally applied to it, I have not been able to find out. In order to remove the acid properties, the trunk is baked, or first grated and then treated as *madrai*, or bread; yet, notwithstanding all precautions, the natives are frequently ill from eating it."*

With the brokka is planted the "taro" or "talo," as is indifferently called the *Colocasia antiquorum*, var. *esculenta*, of Botanists. Two varieties are distinguished, one with a green another with a red petiole. The leaves are cooked and remind a European of spinach, and the root is roasted or grated as in general use throughout the Pacific.

Besides brokka and taro there are two other species of aroids, "Ikamakini" and "Ikourourou," which I have not been able to identify botanically. I commend to future travellers the importance of ascertaining exactly the species of aroids cultivated in Polynesia.

Other varieties of these in cultivation, which have probably been introduced during the present generation from the Gilbert Islands *via* Nui or Vaitupu, are "Ikoroa," "Kairoro," "Ikamava," and "Teioumai."

Bananas (*Musa sapientium*) were planted by the natives in the ground excavated to grow brokka. These low lying swamps

* Seemann—*Flora Vitiensis*, 1865-73, p. 286.

do not agree with the constitution of this plant, which never here attains ordinary height and thickness, and the yield was but a few meagre bunches. On the north-eastern islet there is a plantation on red soil and dry ground, and the bananas here grow more vigorously. In the old time but three varieties were known, the "Sai," "Fungiotagnia," and the "Ngiangia." Of later introduction are the "Fouamouarounga," "Butta," "Tama-tamilema," "Fungipalangi" (*lit.* white man's banana), and "Fouamoualara." That the natives should plant bananas in the swamp suggests that their acquaintance with brokka preceded their knowledge of bananas. The people of Nukufetau possessed no bananas at the time of the visit of the "Peacock," but they recognised some they saw on board as "futi o rotuma."*

An avenue of breadfruit (*Artocarpus incisus*) runs down the length of the village street, whose well grown, leafy and symmetrical trees about forty feet in height add greatly to the beauty of the landscape. A few are also planted on the embankments that separate the fields of brokka, but these are straggling trees with small, scanty foliage, and generally unhealthy in appearance. I was shown by Mr. O'Brien a fruit of another variety introduced from the Gilberts, which he called jackfruit. The leaf I did not see, but I do not think that this Gilbert Island tree was *A. integrifolia*, or I should have detected its presence on the Island by its familiar leaf.

A recent addition from Fiji to the stock of cultivated plants is the sugar cane (*Saccharum officinarum*), which the natives have not yet learned how to grow properly. Instead of planting joints to propagate the species, a whole cane was sacrificed. The sandy soil yields poor, thin rattoons.

A few trees of Pawpaw (*Carica papaya*) planted by the Samoan Mission Teacher near his house, presented a healthy appearance.

FISHING.

Throughout the coral islands of the Pacific fish abound. So plentiful a food supply do they furnish that these specks of land have been able to support a population paralleled alone in density by the cities of civilisation. The two staples upon which human life in every atoll archipelago depends, and around which cluster their distinctive myths, traditions, customs, manners and habits, are fish and coconut.

Skilful fishermen as are the Ellice Islanders, they are surpassed by the inhabitants of the Northern Groups, who having less cultivatable land are probably even more dependent upon their dexterity for their livelihood. They employ in fishing, hooks and line, nets, crab-pots, and torch and spear.

* Wilkes—*loc. cit.*, v., p. 45.

Various hooks (which will later be described more fully in the appropriate section) were designed for different methods of angling. Large wooden hooks were baited with split fish and sunk scores of fathoms for the "palu" and other deep sea fish. Pearl shell hooks "bawonga," were trailed unbaited over the surface to tempt the bonito with their gleaming nacre. Large almost ringed hooks, the "matou tifa," were formerly carved out of pearl shell or hard coral, but these have passed out of use. Though special modes of fishing, as for palu and bonito, still engage the ancient types of hooks used by past generations, yet for ordinary sport the metal hooks of Europeans are in great demand and constant use. European fishing lines I did not see used, the (probably superior) native cord of *Broussonetia* being invariably employed. A favourite bait is the scarlet hermit crab which may be at any time gathered ensconced in a borrowed *Turbo* shell, among coral blocks and palm debris in the most barren parts of the islet. This in Funafuti is known as the "ounga koula," Mr. Whitelegge calls it *Cenobita olivieri*. My tutor in Funafuti fishing taught me to tie the crab bait securely to the hook with English thread.

An extraordinary bait, attractive where all others failed was the ink of the "Feki" or *Sepia*. This was preserved, dried to the consistency of tar, and before using was moistened with kerosene; it was esteemed more fatal if a little European perfume were added. For use, this was just smeared on the tip of an unbarbed hook. It was with some incredulity that I first received this; but experience soon showed that when fishing, not "for the pot," but for the Museum collecting drum, I could obtain numerous dainty species which declined a free passage to Sydney when lured by any ordinary bait. Fish are often devoured raw the moment they are pulled from the sea.* The heavy toll taken by friends and relations when a successful angler returns sometimes induces him to snatch a meal while he may.

Two kinds of fishing nets were observed, a seine and a cast net. They were of the type common throughout the Pacific, and are well described by Turner.† As has been observed by Moresby in New Guinea, Turner in Samoa, and Guppy in the Solomons,‡ the mesh and meshing are identical with European modes. A torn net belonging to one of our party was readily repaired by a native.

The native crab pots I did not see, they were described to me as wove basket-wise out of palm rootlets. No line and floating buoy was used to mark the sunken trap. The fish, they said,

* To show the prevalence of this custom throughout Polynesia, I will merely cite Fanning's notice of it in the Marquesas in the east (Voyages round the World, 1834, p. 145), and Mariner's in Tonga in the west.

† Turner—*loc. cit.*, p. 167.

‡ Guppy—*loc. cit.*, p. 154.

seeing through the clear water the line extending to the surface would thereby be scared away. The trap was lowered to the bottom and unhooked. By taking careful bearings the position could be found and the trap recovered by dragging for and hooking it up. An apparently similar crab pot is described by Dr. Wiley* as employed by the natives of New Britain for capturing Nautili.

At low tide on the reef fish were speared by torch light at night. In the lagoon flaming brands of dry palm attracted the gar fish and flying fish to the canoes. A scene described at Nukunau in the Gilberts by Webster,† was often mirrored by the Funafuti Lagoon, "In the evening, the Island appeared to be completely illuminated along the margin of the beach; hundreds of little lights were in motion by the water's edge, and dancing in the surf. We presently discovered that the natives were busily employed catching flying fish, torches being carried in the canoes for the purpose of attracting them, when they were caught in scoop nets as they rose to the light." Eels in the shore pools were taken by hoop-nets, "titiesi." The "palolo" worm is not known in the Ellice Group.

A year or two ago considerable quantities of pumice drifted ashore, and the native mind linked this to the fact that a man died after a meal of fish taken on the outer reef. All fish from the outer beach were after this occurrence held to be unwholesome, but the fish from within the lagoon still continued to be eaten. At the time of our visit, it was yet considered unsafe to eat any fish from the ocean beach, though it was believed that at some future date they would again become fit for consumption.

The bright hued labroid fishes are eaten though poorly esteemed. A Giant Ray, *Ceratoptera* sp., was harpooned in shoal water in the Lagoon; the huge fins were cut off to make a meal for the families of its captors. As previously noted the barracouta in former days was sacred to the priests. On Arorae in the Gilberts the Rev. W. W. Gill records in his Diary that sacred fish only eaten by the priests were the shark and the turtle.

The only turtle occurring at Funafuti is the Green Turtle, "Fonu," *Chelone midas*, which is far from common, one example only being taken during our stay on the atoll. From its shell an axe, "taku-fonu," was formerly made, and domestic utensils are still fashioned from its bones. In Queensland the Aborigines manufacture the carapace of this Chelonian into a shield.‡ In past times, owing doubtless to its rarity, the flesh of the Funafuti turtle was meat

* Wiley—Natural Science, vi., 1895, pp. 409 and 414, fig.

† Webster—*loc. cit.*, n.d., p. 31.

‡ Etheridge, Junr.—Proc. Linn. Soc. N.S.W. (2), ix., 1894, p. 508, pls. xxxv. and xxxvi.

tabued to all but the king. If the captor of a turtle tasted a morsel thereof he was heavily fined, being required to at once bring it to the king. Then, according to ancient ceremonial, the turtle being laid upon its back, the head turned towards the door before the house of the king, the king himself wrapped in fine mats pronounced over it the following incantation :—

Te ulu o te Fonu e soa,
 Te ikamua e soa,
 Te ikamuli e soa,
 Te vaesiosio e soa,
 Te alaya mua e soa,
 Te matua tinae e soa,
 Te pulou e soa,
 Te matua tua e soa,
 Te gakau e soa,
 Te laukape e soa,
 Te fatumanava e soa,
 Te ate e soa,
 Te mama e soa,
 E kiukiu te fua.

For the following translation of the above I am indebted to Mr. John O'Brien, the resident trader :—

Incantation to Turtle.

The head of the turtle is alike,
 The two fore flappers are alike,
 The two hind flappers are alike,
 The white and the green fats are alike,
 The heart is alike,
 The belly shell is alike,
 The back shell is alike,
 The guts are alike,
 The yellow fat is alike,
 The heart is alike,
 The rump is alike,
 The lights are alike,
 Thousands and thousands of eggs.

At Tonga Mariner tells us that, "Turtle are considered almost a prohibited food, at least very few will venture to eat them without first offering a portion to some god, or sending some to any chief that may be at hand."*

At Rakaanga Dr. Gill informs us that, "All turtle were formerly sacred, being eaten only by kings and priests.† It is

* Mariner—Tonga, ii., 1817, p. 133.

† This writer has published an interesting legend from Rakaanga (The South Pacific and New Guinea, 1892, p. 38), where the "motif" is the failure of the people to bring to the king the sacred turtle."

quite otherwise now (except at Rarotonga, &c.).” And at Penrhyns, “Turtle and porpoises were eaten only by men. The superstition of those days was that if a woman ate of the porpoise, her children would have porpoise faces.”*

At Daudai, New Guinea, “Everything is eaten without regard to persons or occasions except the flesh of the porpoise.”†

Porpoises‡ are occasionally captured by the men in a fleet of canoes, who drive a shoal of them to the beach in front of the village, and when penned in shallow water the women wade into the sea and haul them ashore. It is impossible, I am told, to grasp a porpoise by the tail, but by putting an arm round the animal’s head, it may be dragged ashore with ease. Some women even capture two at once, and with one tucked under each arm successfully land them.

The following graphic description is from the pen of Dr. Gill :§ “Shoals of porpoises are occasionally driven ashore by the Penrhyn Islanders ; they think it poor fun if the result is less than four or five porpoises apiece. When a shoal comes in sight, as many boats and canoes as they can muster, each carrying large stones, go right out to sea to cut off their retreat. The porpoises are easily driven towards shore by the sight of approaching boats and the shouts of excited natives. On nearing the reef, some of the big stones are dropped into the sea to add to their alarm. Again and again great stones are dropped. When close in, numbers of natives dive down among them, until, in sheer terror, they rush through the boiling surf on the reef, and are at once despatched by those ashore.”

With expressions of disgust, the natives received the information that beche-de-mer were eaten in some countries. Unlike the Samoans, the Funafuti Islanders were unacquainted with Echini as articles of food.

I was surprised to find how little the Mollusca were laid under contribution. The large *Pteroceras lambis*, “Karea,” I saw eaten raw and roasted. *Tridacna squamosa*, “Fasua tuka,” and *T.*

* Gill—Jottings from the Pacific, 1885, pp. 128 and 146.

† Beardmore—Journ. Anthropol. Inst., 1890, p. 462.

‡ Throughout Australasia this is the only name by which *Delphinus* is known, a misapplication of even greater popularity than the Australian “Iguana” and “Alligator.”

§ Gill—*loc. cit.*, p. 147. Whilst these pages were receiving their final revision, the friends of this veteran Missionary and Author are deploring his loss. The late reverend gentleman evinced a most kindly interest in the progress of this Report, and, as will be seen from the numerous references, placed his MS. notes and experience unreservedly at my disposal.

elongata, "Fasua noa," were habitually used. The former clam was sometimes collected and stored near the village on rocks under water till required. A *Sepia*, which I did not see, the "Feki," was esteemed a delicacy. The children amused themselves by collecting from the sandy beach, cooking and eating *Paphia mitis*, "Assouri." Piles of shells confirmed the statement that the *Strombus luhuanus*, "Paneia," was consumed. There were pointed out to me as eatable, an *Arca*, "Kashi," a *Chama*, "Saupou," *Nerita*, "Sebo," *Asaphis deflorata*, "Kosh," and *Vermetus maximus*, "Gea."

Of Crustacea the Robber Crab, *Burgus latro*, "Taou," and the crawfish *Palinurus guttatus*, "Oula," were prized.

HYGIENE.

The visit of a ship, though an agreeable break in the dull monotony of atoll life, is yet almost as much dreaded as welcomed. For such contact with the outside world almost invariably induces a severe cold from which the whole population suffers. Upon the arrival of our party in H.M.S. "Penguin," it was not observed that any of the visitors had a cold, yet in a few days all the islanders were coughing and sneezing from a severe attack of cold which they said the ship brought.

Mr. Whitmee, "once visited several islands of the Ellice Group about a fortnight after a trading vessel from Sydney, which had influenza on board. This vessel had taken some of the natives from one island to another as passengers, and at three of the islands the entire population was suffering from the epidemic. Had this been a more severe disease the people would have been utterly helpless."*

From some manuscript notes made during his voyage round the Ellice Archipelago and kindly placed at my disposal by the Rev. W. W. Gill, LL.D., I learn that he saw on Nanomana, "a woman carrying a pendulous excrescence weighing doubtless 75 lbs. (= elephantiasis pudendi—a rare thing)," also that it was the custom for the women in attendance at a birth to taste the uterine hæmorrhage which occurs after parturition. From the same source I extract the following:—"At Vaitupu, circumcision is *not* practised; but instead of it the prepuce of little boys is drawn back over the glans and left thus. As at Niue it is clear (indeed they assert the fact) that their ancestors were in the habit of practising circumcision." Also at Vaitupu, "It was a common custom before the introduction of Christianity, to cut off a joint of a finger on the death of a child, or any other member of the

* Whitmee—Art. Polynesia, Ency. Britt. (9), 1885, xix., p. 422, foot note.

family specially beloved. On shaking hands I noticed almost every third woman had lost a finger or more of the right hand, and some gave the left rather than expose the mutilated hand.”*

Under the heading of Vegetation will be found what notes I could collect of plants used medicinally by the natives. And in the Ethnological Section will follow an account of the lancets used for blood letting. To the kindness of my friend, Surgeon F. W. Collingwood, R.N., of H.M.S. “Penguin,” I am indebted for the following interesting notes.

Prevalent Diseases of Funafuti.

“*Ruffa*, or Tokelau ringworm, *Tinea desquamosa*.† The skin appears rough and scaly from constant desquamation, in many cases the whole body is affected, in others the face and neck are the parts attacked. The rate of desquamation varies considerably, where the process is slow the skin is covered in small patches an inch and a half by an inch in size; desquamation commencing at the borders of these small patches causes sinuous outlines running one into the other. The scalp seems to entirely escape the disease. As indications of scratching are only occasionally seen, it seems that the irritation caused by this condition is only moderate, and in the two cases where such indications occurred the disease had attacked the face and neck.

“*Ruffa*, when cured, leaves a peculiar mottled appearance of the skin, usually a lighter tint is produced by diminution of the colour, but the opposite effect appeared when persons of advanced age had been attacked. Never does the skin regain its smooth velvety condition.

“Most encouraging results were obtained by a treatment of this disease which consisted in washing the patient with soap and water to remove as many of the scales as possible, after thorough drying the patient was told to rub with ointment two or three times a day for three days, then to leave the ointment on the body for two or three days and finally to again wash the body with soap and water; the process being repeated two or three times. In a case under my treatment where the disease was limited in area, three such applications sufficed to effect a cure.

“The following perscription proved very beneficial, and after employment in cases which I personally superintended, and with

* Whitmee—A Missionary Cruise in the South Pacific, 1871, p. 16. A finger joint was sacrificed in Tonga for the recovery of sick relations.—Mariner—Tonga, ii., 1817, p. 222.

† Bakua or Tiripa in New Britain. Danks—Proc. Austr. Assoc. Adv. Sci. for 1892 (1893), p. 616. For a full discussion of this disease, see Guppy—Solomon Islands, 1887, p. 172.

whose results I was most gratified, was an ointment in great request among the natives:

Chrysophanic acid	...	...	2 drachms
Liquor picis ligni	...	...	2 ounces
Carbolic acid	...	...	20 drops
Beeswax...	...	...	2½ drachms
Clarified Lard	...	...	1 pound

There is little doubt that the essential element in killing the parasite is the Chrysophanic Acid, and the Liquor picis ligni diminishes the tendency to inflammation which is apt to be caused by the Chrysophanic Acid. The latter also gives a pleasant smell which is congenial to the native.

"After constant application for a fortnight one case was cured by this prescription:—

Ammonia chloride of mercury...	1 ounce
Liquor picis ligni	1 ounce
Beeswax...	2½ ounces
Clarified lard	1 pound

"*Tonna*.*—There is a disease called Tonna, which consists of a scattered pustular eruption attacking the face, neck, trunk and limbs of children between one and three years of age. In severe cases it lasts from three to eighteen months, during which time the general health of the child seems to be deficient. The comparatively healthy skin between the pustules is dull, dry, and has, as a rule, lost its smooth soft state. In severe cases the pustules, through dirt, neglect, and unhealthiness of constitution, are apt to break down into an ulcerative process causing cicatrical contraction in healing.

"In a few cases this ulcerative condition and its results are seen in adults, and, when attacking the face and neck, causes much disfigurement, exposing the mucous surface of the eyelids, lips, &c, and in one case, if not fixing the head in an immobile position, at least rendering considerable diminution in movement.

"Amongst the adult population, besides the above described conditions, periosteal enlargement of the tibia and arm bones occur, which is occasionally accompanied with pyrexial attacks lasting for a few days, when increased pain and tenderness over the nodular masses is experienced.

"Again, a similar ulcerative process that attacks the skin, takes place in the mucous membrane, bones and cartilage of the nose and larynx, causing a marked flattening of the nose.

* Compare H. S. Cooper—Coral Lands, ii., 1880, p. 73. The Tongans knew this disease by the same name in the first decade of the century, *vide* Mariner—*loc. cit.*, ii., p. 270.

"From the foregoing remarks it will be gathered, that between these symptoms and the ordinary course of specific disease there are many points of similarity. Before proceeding further it is well to state that I was unable to find any venereal disease amongst the natives; in fact, disease the result of intercourse seemed unknown. Yet though, in the disease called "tonna," there was no point observable of primary inoculation, many of the symptoms are allied to those noticed in the course of a syphilitic history; thus the pustular symptom is similar to the secondary rash of syphilis, the ulcerative process apt to follow the above lesion might be said to correspond to the reminder or early tertiary stages, while the periosteal nodes and the ulcerative process of the nasal cartilages would be the tertiary stage. This comparison of course presumes that the periosteal condition, &c., is a direct result or sequence of the early pustular disease. And in support of this presumption it may be added, that in all patients who had these periosteal manifestations that there were indications or history of tonna. On the other hand, it may be said that most natives have had tonna.

"Ordinary care and protection much improved the pustular or early ulcerative state, and specific remedies were most efficacious in ulcerative and periosteal conditions.

"Several cases of permanent blindness among the natives had been caused by Keratitis and Iritis. One case of Iritis developing in a lad of eighteen from no apparent cause, was effectually cured by atropine solution locally supplied, with two grains of mercury and chalk given twice a day for a fortnight."



ROCK SPECIMENS FROM FUNAFUTI.

By T. COOKSEY, PH. D., B. SC.,

Mineralogist and Chemist, Australian Museum.

[II.]

ROCK SPECIMENS.

By T. COOKSEY, Ph. D., B. Sc.,

Mineralogist and Chemist, Australian Museum.

THE following are brief Notes on the Rock Specimens collected by Mr. C. Hedley :—

Coarse Sand.—A specimen of coarse sand from the western sea beach of the Atoll, consists principally of waterworn fragments of coral and coral rock, comminuted or small shells, the tests of the Foraminifera *Orbitolites complanata*, *Tinoporus baculatus*, and to a smaller extent *Polytrema muriaceum*, *Amphistegina lessonii*, and a few fragments of Echinoderms. It is entirely calcareous.

Calcareous Conglomerate.—A calcareous conglomerate was obtained from the bore put down at Luamanif, on the southern sea coast of the islet of Funafuti, at a depth of ten feet. The mass is rather loosely cemented together, and the individual particles are similar to those composing the beach sand. Their relative quantities, however, differ somewhat. The tests of *Orbitolites complanata* although numerous, do not form such a large proportion of the mass, while those of *Amphistegina lessonii* are much more numerous represented. It also contains well worn pebbles of coral rock up to one inch and one inch and a half in length. A thin layer of carbonate of lime encrusts all the components and forms the cementing material. This coating has previously been noticed by Mr. J. E. Carne* to occur on surface sand at Norfolk Island.

Conglomerate.—A firmly coherent conglomerate containing similar materials to those of the preceding rock, the tests of *Orbitolites complanata*, however, appearing to be relatively still less numerous. The mass consists more especially of waterworn pieces of coral-rock, with a large proportion of the tests of both *Tinoporus baculatus* and *Amphistegina lessonii*. It is much consolidated by a deposit of carbonate of lime around each separate

* An. Rep. Dep. Mines, N.S.W., for 1885, p. 145.

particle, which is considerably heavier than that in the preceding specimen, but has not been sufficient to fill up the interstitial spaces.

Coral-Rock.—A portion of coral-rock obtained from the breccia about a mile south of Luamanif at about the high tide level. The structure of the coral has been much impaired. This is due to subsequent alteration, which has consolidated the mass leaving only a few small pores.

Analysis.

Hygroscopic moisture...	...	...	0.27
CaCO ₃ ...	...	...	97.69
MgCO ₃ ...	...	...	1.69
P ₂ O ₅ ...	...	...	trace
			99.65

Soil from Taro Plantation.—The plantation lies in the centre of the main islet of Funafuti, and the soil has been formed from beach sand, enriched with decayed vegetable matter. The various components of the sand are distinctly seen, some of the tests of the smaller Foraminifera being still but slightly damaged.

An analysis of an air-dried sample gave the following results:—

Hygroscopic moisture...	...	...	1.81
CaO ...	...	...	47.23
MgO ...	...	...	1.07
K ₂ O ...	...	...	.05
Na ₂ O ...	...	...	.44
Fe ₂ O ₃ ...	...	...	.28
P ₂ O ₅ ...	...	...	6.00
SO ₃ ...	...	...	.44
Cl ...	...	...	.02
CO ₂ ...	...	...	33.65
Organic matter ...	...	...	8.97
Residue (insol. HCl.)...	...	...	.04
			100.00

The large percentage of phosphoric acid would seem to shew that a considerable quantity of animal matter, either in the shape of bones or excrement has been added to this soil as a manure, Mr. Hedley, however, failed to observe that any other means of enriching it was employed beside the addition of green leaves and decayed vegetable matter.

Pumice Pebbles.—Pebbles of pumice stone, the largest of which resemble a walnut in size, all much water worn and rounded, were collected from various places on the outer circumference of the Atoll, and possibly occur on all of these islets. They possess a fibrous texture, and contain macroscopic crystals of sanidine. The colour varies from light to dark grey, one or two having a brown or greenish tinge. Similar pebbles occur on most of these Pacific Islands,* and along the eastern coast of Australia.†

An analysis of one which was much rounded by attrition, and possessed a very light grey colour, gave the following percentage composition :—

Hygroscopic moisture...	...	...	...	...	0.09
Loss on ignition	...	...	...	...	2.29
SiO ₂	...	...	...	...	66.50
Fe ₂ O ₃	...	...	...	...	3.21
Al ₂ O ₃	...	...	...	...	16.84
CaO	...	...	...	...	3.03
MgO	...	...	...	...	1.03
K ₂ O	...	...	...	...	5.44
Na ₂ O	...	...	...	...	2.53
P ₂ O ₅	...	...	...	...	trace
					100.96

A partial analysis of another pebble of a darker shade gave 60.37 % of SiO₂.

On referring to analyses already published of drift pumice, the figures above are seen to agree very closely with that made by Prof. A. Liversidge, F.R.S., of white pumice found on the beach at Bondi, near Sydney,‡ and again with some others published somewhat earlier of ashes and pumice derived from the eruption of Krakatoa in 1883. The pebbles examined by Prof. Liversidge were collected before this eruption took place, but he suggests that this volcano may have been the source from which the pebbles were derived.

It is possible, of course, that the specimen obtained from Funafuti may have found its way from there also, as its analysis would seem to suggest; but its path would have been so long and devious, that one naturally turns to a nearer and more likely source. An obvious one is that of Tanna, in the New Hebrides. In the same publication, however, Prof. Liversidge gives some analyses of dark or black lava from the latter place, which differ

* Cf. The Solomon Islands, by H. B. Guppy.—Nature, Dec. 5, 1878.

† Cf. Jukes.—Voyage of H.M.S. "Fly," 1847, p. 336.

‡ Journ. Roy. Soc. N.S.W., xx., 1886, p. 235.

very considerably in composition from that of the white pumice found either at Bondi or Funafuti.

It would perhaps be of interest to append these analyses for comparison.

White Pumice, Bondi.

Moisture at 100° C. ...	...	...	...	1.818
SiO ₂ ...	...	...	...	68.149
Al ₂ O ₃ ...	...	...	...	16.493
Fe ₂ O ₃ ...	...	...	...	3.255
MnO ...	...	...	...	.256
CaO ...	...	...	...	4.005
MgO ...	...	...	...	none
Na ₂ O ...	...	...	...	3.881
K ₂ O ...	...	...	...	1.590
				99.447

Krakatoa, 1883.

	No. 1	No. 2	No. 3
Loss of ignition...	2.17	2.74	2.12
SiO ₂ ...	63.30	65.04	68.06
Al ₂ O ₃ ...	14.52	14.63	15.03
Fe ₂ O ₃ ...	5.82	4.47	.28
FeO ...		2.82	3.66
MnO ...	.23	trace	trace
CaO ...	4.00	3.34	2.71
MgO ...	1.66	1.20	.81
Na ₂ O ...	5.14	4.23	4.25
K ₂ O ...	1.43	.97	3.41
TiO ₂ ...	1.08	...	.38
99.35		99.44	100.71

NOTE.—No. 1 by Sauer, No. 2 by Renard, No. 3 by K. Oebbeke.—
Journ. Chem. Soc., 1884, pp. 974-5.

AVES FROM FUNAFUTI.

By A. J. NORTH,

Ornithologist to the Australian Museum.

[III.]

AVES.

BY ALFRED J. NORTH, C.M.Z.S.,
Ornithologist to the Australian Museum.

THE Ornithological Collection made by Mr. Hedley consists of six specimens, referable to four well known Australasian species, and one egg. Mr. Hedley has supplied an interesting note on the "Lakea" (*Micranous leucocapillus*). Although found on most islets near the line, *Totanus incanus* and *Sterna melanauchen* have not, I believe, been previously recorded from the Ellice Islands.

1. TOTANUS INCANUS.

Grey-rumped Sandpiper.

Scolopax incana, Gmel. Syst. Nat., Vol. i. p. 651 (1788).

Totanus incanus, Vieill. Nouv. Dict., tom. vi. p. 400 (1816).

Totanus griseopygius, Gould, Proc. Zool. Soc. 1848, p. 39; *id.*
Bds. Austr. Vol. vi. pl. 38 (1848).

Actitis incana, Finch, Ibis, 1880, pp. 432, 434 (Gilbert Islands).

One adult female in winter plumage. Wing 6·9 in. This specimen was obtained on the margin of a mangrove-lined swamp on Funafuti. *T. incanus* in winter dress is not uncommon on the shores of Botany Bay, New South Wales, during the months of October and November.

2. DEMIEGRETTA SACRA.

Reef Heron.

Ardea sacra, Gmel. Syst. Nat., Vol. ii. p. 640 (1788); Finsch, Ibis, 1880, pp. 432, 433 (Gilbert Islands).

Herodias jugularis, G. R. Gray, List Spec. Bds. Brit. Mus., p. 80 (1844); Gould, Bds. Austr. Vol. vi. pl. 60 (1848).

Herodias greyi, G. R. Gray, List Spec. Bds. Brit. Mus., p. 80 (1844); Gould, Bds. Austr. Vol. vi. pl. 61 (1848).

One adult specimen obtained on the reefs near the village. Throat whitish, remainder of the plumage dark slate-colour. Fairly common on the reefs and beaches, specimens being seen in all stages of plumage, white, dark slate colour, and parti-coloured birds. Dr. Finsch, who met with this species in the Gilberts, writes as follows in his interesting "Letters from the Pacific"*:—

"*Ardea sacra* was more plentiful than in the Marshalls, and on some places not at all shy, coming close to the huts of the natives and perching on the neighbouring trees. That white and slate-coloured specimens belong to one and the same species is a well known fact, which I confirmed formerly by the investigation of full materials received from the Pacific, and which I can now verify from my own experience. In Butari-tari I saw uniformly white birds going always in pairs; I also saw pairs, undoubtedly male and female, of which the one was white the other slate-coloured, or both of the latter colour or mixed with white. There seems to be no regularity of sex or age, for even birds in the dirty pale slate garb, which I always took for the first plumage, proved to be old.

When on Tarowa, 12th December, a gentleman of the vessel went out shooting, and brought home six specimens; there were two males slate-coloured, one female white, spotted with slate, one female uniformly white. All the females, even one which I thought to be a young bird, had very small ovaries, but a large patch destitute of feathers (a so-called breeding patch) covering the whole belly. The gentleman told me that he had met a whole colony of this Heron in some shrubs, and that he felt sure they would have nests there. We intended to visit the spot again, but were disappointed, for the vessel was not going in pursuit of eggs and birds but natives, and to make a harvest the brig had to leave, so we could not remain behind."

This species has been found breeding on the small islets lying off the north-east coast of Australia, also on the islands of Bass Strait. The nests are built of small sticks and are placed in low trees, or are constructed of coarse grasses and hidden under the shelter of an overhanging ledge of rock. The eggs are of a pale greenish-white, and vary in shape from a true ellipse to swollen oval, an average specimen measures 1.95 x 1.4 in. Nests found by Mr. Macgillivray on the islands off the north-east coast of Australia and Torres Strait contained two eggs for a sitting, those found by Mr. J. A. Boyd in Fiji had three eggs, while nests found by Dr. Holden on the islands adjacent to the north-west coast of Tasmania contained from two to four eggs for a sitting. Three, however, is the usual number laid in the latter locality.

* Ibis, 1880, p. 432.

3. STERNA MELANAUCHEN.

Black-naped Tern.

Sterna melanauchen, Temm. Pl. Col., Vol. iv. pl. 427 (1827); Gould, Bds. Austr., Vol. vii. pl. 28 (1848, Torres Strait); Finsch, Ibis, 1880, pp. 431, 433 (Gilbert Islands); North, Nests and Eggs Austr. Bds. p. 356 (1889), egg; Saunders, Cat. Bds. Brit. Mus., Vol. xxv. p. 126 (1896).

“Agiagi,” Natives of Funafuti.

One adult female, shot while feeding on the beach not far from the village. Wing 8·5 in. Not common.

4. MICRANOUS LEUCOCAPILLUS.

White-capped Tern.

Anous leucocapillus, Gould, Proc. Zool. Soc. 1845, p. 103 (Raine Islet, North Australia); *id.* Bds. Austr., Vol. vii. pl. 36 (1848); Sharpe, Proc. Zool. Soc. 1878, p. 273 (Ellice Islands).

Anous melanogenys, Gray, Gen. Bds., Vol. iii. p. 661, pl. 182 (1846); Crowfoot, Ibis, 1885, p. 246 (Norfolk Island, breeding); North, Nests and Eggs Austr. Bds., p. 376, pl. xxi. fig. 5 (1889), Norfolk and Phillip Islands.

Micranous leucocapillus, Saunders, Cat. Bds. Brit. Mus., Vol. xxv. p. 146 (1896).

“Lakea,” Natives of Funafuti.

Two adult males in full breeding plumage, and a nestling. Wings of adult measures 9 inches. One egg of a faint creamy-white ground colour, minutely dotted and blotched with dull purplish brown particularly on the larger end, some of the markings appearing as if beneath the surface of the shell; length 1·82 x 1·26 in.

Mr. Hedley has contributed the following note relative to this species:—

“The ‘Lakea’ breeds freely on the smaller islets of the atoll, which being destitute of fresh water are not habitable by natives. On the main islet it is too harrassed to nest. In the tall Pouka trees (*Hernandia peltata*, Meissn.) it swarms in such numbers that half-a-dozen birds may be knocked over at a shot. Uttering their hoarse cry the remainder of the flock wheel round and settle in a few moments on the adjacent trees. On June 30th I landed on one of the leewards islets with a native, and found the ‘Lakea’ nesting in great numbers in the branches of the Fala (*Pandanus odoratissimus*); each tree was so crowded with nests that a fork was rarely unoccupied, and where a limb was sufficiently broad and horizontal that too was utilised for a site, one bough might thus carry a dozen nests. Their structure was of the most flimsy description, and defied my efforts to preserve a

whole specimen for the Museum, consisting as they did of scraps of Fala leaves plastered together with excrement, and scantily lined with a few tufts of coarse fibre. I sent the native to procure the eggs, but in most cases the young birds were commencing to fly, and my friend Tanai ascended several trees in vain before he was rewarded with a couple of eggs, one of which proved addled, and the other was safely brought to Sydney. With a few well directed stones Tanai knocked over some fledglings. Plucking but not drawing these, he spitted them on a split cocoanut midrib, and toasted them over a wood fire. They were very fat and tender, and on these and the pithy interior of a sprouting cocoanut we made an excellent breakfast.

Netting these birds is a sport much enjoyed by the natives. The 'shaou shaou,' made like a butterfly net, has a bag about 3 ft. by 2 ft. of four-inch meshes of fine sinnet twine, spread on a wooden hoop and mounted on a ten foot pole. After dark the party of hunters walk out quietly to the scene of operations. One, divesting himself of his dress for greater freedom of movement, ascends a low tree and gaining a suitable station, imitates by a purring sound of his lips the call of the Lakea. A bird flies up answering the call, and at a sweep the decoyed tern is struggling in the net. The trapper does not kill the bird, but twisting its wings across its back ties the longer quills together or latches one wing into the other, and flings the struggling bird to his mates. If another kind of bird comes in sight the call is changed, and with a whizzing sound it too is deluded to within reach of the fatal net. These calls are very difficult to voice, few even of the natives do it well, and a European can hardly hope to succeed. When the man aloft is tired another of the party relieves him. Perhaps in one night a hundred birds would fall to a net, providing a great feast on returning to the village. Another method requiring less skill is to take the birds by a smaller net set at an angle to the long handle. Creeping quietly up to the tree the fowler, standing on the ground, sweeps or rather 'spoons' the roosting birds off the bough."

The following is a list of the birds obtained in the Ellice Islands by Mr. Fritz Jansen in 1876, and which formed the basis of a short paper by Dr. R. B. Sharpe, to whom they were submitted by the Rev. S. J. Whitmee for determination* :—

1. *Ardea sacra*.
2. *Procelsterna cœrulea*.
3. *Anous stolidus*.
4. *Micranous leucocapillus*.
5. *Sterna anæstheta*.

* On a Small Collection of Birds from the Ellice Islands. By R. Bowdler Sharpe, F.L.S., F.Z.S., &c. With a note on the other birds found there. By the Rev. S. J. Whitmee.—Proc. Zool. Soc., 1878, p. 271.

In a note contributed by Mr. Whitmee he writes as follows:—

“In addition to the birds included in the foregoing list, he (Mr. Jansen) saw a *Carpophaga* in the Ellice Islands; and the Frigate-bird (*Fregata aquila*) also occurs there. In fact the latter bird is domesticated by the natives; and when I was in those islands in 1870, I saw scores of them about the villages sitting on long perches erected for them near the beach. The natives procure the young birds and tie them by the leg and feed them till they are tame. Afterwards they let them loose, and they go out to sea to get their food, and return to their perches in the villages at intervals. I cannot say to what species the *Carpophaga* is referable, not having seen it myself. Mr. Jansen procured young ones in May and June; but he thinking that they were the same as the Pigeon found in Samoa (*C. pacifica*), did not preserve any specimens. Natives of the Ellice Islands who were in Samoa when I left there told me their Pigeon is like the Samoan species, “except that it is smaller owing to its food being less plentiful.”

Mr. Hedley informs me that he did not see any tame Frigate-birds on Funafuti, but on Nukulailai on August 2nd, 1896, he saw one unattached on a tall perch in front of the teacher's house. There is no doubt, however, that *Fregata aquila* still inhabits Funafuti or some of the neighbouring atolls, for the “titi's” brought back by Mr. Hedley and worn by the natives of both sexes on festive occasions, were ornamented with the feathers of this species.

The use these birds were put to as message carriers between the scattered atolls of the Ellice Group, is thus described by the Rev. Dr. George Turner, of the London Missionary Society*:—

“When I visited the group in 1876, I found that the Samoan native pastors on four of the islands were in the habit of corresponding by means of carrier Frigate-birds. While I was in the pastor's house on Funafuti on a Sunday afternoon, a bird arrived with a note from another pastor on Nukufetau, sixty miles distant. It was a foolscap 8vo leaf dated on the Friday, done up inside a light piece of reed, plugged with a bit of cloth, and attached to the wing of the bird. In former times the natives sent pearl-shell fish-hooks by Frigate-birds from island to island. I observed they had them as pets on perches at a number of islands in this “Ellice Group,” fed them on fish, and when there was a favourable wind the creatures had an instinctive curiosity to go and visit another island, where on looking down they saw a perch, and hence our Samoan pastors, when they were located there, found an ocean postal service all ready to their hand!”

* Turner—Samoa a hundred years ago and long before. 1884, p. 282.

Mr. C. M. Woodford, who visited the Gilbert Group in 1884, records in the "Geographical Journal"* seeing several of these birds captured on one of the islands, and which he was informed were used for similar purposes. He writes as follows:—

"These natives catch and partially tame the Frigate-bird, and employ it to convey messages from island to island. I was informed of this fact by the natives, but was loth to believe it. At Apamama I saw, however, three of the birds kept upon T-shaped wooden perches opposite to the king's house. A long line was tied to their tails. When wild birds were seen, some fish were thrown upon the ground, and the captive birds made to take wing. By this means the strangers were induced to settle, and while engaged in feeding on the fish, a line at the end of a rod about six feet long, having at the end a stone about the size and shape of a fowl's egg, was thrown over them, whereby their wings became entangled and they were caught. I saw the tame birds and the apparatus for catching the wild ones; but although some were seen, they could not be induced to settle, so that I missed seeing the most interesting part of the performance."

In June, 1896, the Hon. C. R. Swayne, late H.B.M.'s Resident at the Gilbert and Ellice Groups writes me as follows:—"I could never find that the Frigate-bird was used to convey messages between islands. The old men always laughed at the idea."

Although the Pigeon inhabiting the Ellice Islands has been often observed, I can find no record of adult specimens having been obtained, but there is little doubt that the birds seen by Mr. Jansen on Funafuti in 1876, and on Niu in 1895, were correctly identified by them as *Globicera pacifica*.

To Dr. Sharpe's and the Rev. S. J. Whitmee's list of the Ellice Island birds may now be added *Urodynamis taitensis*, observed by Mr. Swayne on Niu,† and *Totanus incanous* and *Sterna melanauchen*, collected by Mr. Hedley.

The number of species at present known to frequent the islands of the Ellice Group will be considerably augmented when the collection formed by Mr. Gardiner, one of the members of the same expedition, is worked out.

* The Gilbert Islands—Geogr. Journ. (1895), vi., 4, p. 347.

† Note on a Cuckoo taking possession of a Tern's nest, by A. J. North—Proc. Zool. Soc. (*in lit.*)

THE INSECT FAUNA OF FUNAFUTI.

By W. J. RAINBOW,

Entomologist, Australian Museum.

[IV.]

THE INSECT FAUNA.

By W. J. RAINBOW,

Entomologist, Australian Museum.

AMONG the memoranda handed to me by Mr. Hedley in connection with the insects collected at Funafuti, the following remark occurs:—"The collection brought back does scanty justice to the Entomological fauna of Funafuti, whose claims were, I fear, unduly subordinated to the demands of the Marine Invertebrata, the spiders being the only group whose proportions are at all fairly represented."

Small as the collection is, however, it is not by any means devoid of interest, for while there are individuals amongst it that are well known to Entomologists, there are also some that are new. Indeed, it would be strange if it were not so, when we consider the rich fields awaiting the labours of systematic workers among the islands of the Pacific, that are, as yet, comparatively untouched. And it must also be borne in mind, that the fauna of the islands comprising the various groups—of which the Ellice Group is one—is of a more or less derived nature—that is to say, the fauna of any one island or group can scarcely be considered as appertaining solely to it, but must be studied from a much broader standpoint, not only as regards the distribution of the genera, but also of the species. Thus, for instance, amongst the beetles, *Sphenophorus sulcipes*, Karsch, originally recorded from the Marshall Islands* was obtained by Mr. Hedley at Funafuti; and amongst the butterflies *Junonia vellida*, Fabr., also obtained by Mr. Hedley, is not only common in the Ellice Group,† but also at the Gilbert Islands,‡ and coming nearer home—Australia. Then there are the mosquitoes—*Megarrhina inornata*, Walk., being found both in New Guinea and the Ellice Islands. Being possessed of this knowledge, therefore, it is only reasonable to

* Berlin. Ent. Zeit., xxv., 1880, p. 11, pl. i., fig. 16.

† Proc. Zool. Soc., 1878, p. 297; Ann. and Mag. Nat. Hist. (5), xv., p. 258.

‡ Geogr. Journ., vi., 4., 1895, p. 348.

assume that a systematic collection would bring to light other facts of an interesting nature, and demonstrate clearly that the insect fauna of one island or group is only more or less the reflex of another. In his valuable paper on "The Gilbert Islands,"* Mr. C. M. Woodford says, in endeavouring to account for the insect fauna he found there:—

"Of the insect fauna, the scorpions, spiders, most of the beetles, *Evania appendigaster*, the ants, the blatta, and the earwig, were most probably conveyed to the islands by ships.

"The remaining insect fauna, comprising the butterflies, eleven moths, three species of hymenoptera, one of the hemiptera, the locusta and the dragon-flies, were probably wind-borne, and I think that such of them as are not of almost cosmopolitan range most probably reached the group through the Marshalls.

"Of the two species of butterflies, *Junonia vellida* is generally distributed throughout the Pacific Islands, but *Hypolimnys rarick*, so far as I know, although found in the Marshalls, does not extend further to the south-east than the Gilbert Group."

The eleven species of moths taken by Woodford during his visit to the Gilbert Islands in 1884 were†:—(1) *Charocampa erotoides*, (2) *Cephonodes hylas*, (3) *Deiopeia pulchella*, (4) *Prodenia retina*, (5) *Amyra oeto*, (6) *Heliothis armigera*, (7) *Catephia linteola*, (8) *Archæa melicerte*, (9) *Remigia translata*, (10) *Marasmia creonalis*, and (11) *Chloanges suralis*. The latter insect was described by Mr. Butler as a new species, under the name of *Margeronia woodfordi*, but he has since identified it with *Chloanges suralis* of Zeller.

Of these Mr. Woodford remarks‡:—"Nos. 1, 3, 4, 5, 6, 7 and 10 may be said to be cosmopolitan, extending throughout the East generally, and to the more remote islands of the Pacific from Australia to Tahiti.

"No. 2, *Cephonodes hylas*, is also found in West Africa, South Africa, Natal, North India, Moulmein, Moreton Bay, and Japan. Being a very handsome and conspicuous insect, it would not be likely to escape observation; but I never observed it in the Solomons nor in Fiji, so that its range into this group was most probably through the Marshalls.

"No. 9, *Remigia translata*, is recorded from Ceylon, and from the Marshall Islands. I also met with this insect in the Ellice Group.

* *Loc. cit.*, p. 349.

† *Geogr. Journ.*, vi., 4, 1895, p. 348; also *Ann. Mag. Nat. Hist.* (5), xv., pp. 238-241.

‡ *Geogr. Journ.*, vi., 4, 1895, pp. 349-350.

"No. 11, *Chloanges suralis*, occurs in Amboina, in the Marshalls, and Mr. Matthew took it in the Ellice Group. Its food plant occurs commonly in Fiji, but I never noticed the insect there, nor is it recorded among the extensive collection made there by Mr. Matthew. I did not notice it in the Solomons.

"It would appear probable, therefore, that the three last-named species have reached the Gilberts *via* the Marshall Group."

In the Gilbert Group, Dr. O. Finch collected the following moths:—*Sesia mylas*, *Sphinx urotus*, and *Utetheria pulchella*.*

While upon the subject of the Heterocera, it will be of interest to point out that *Deiopeia pulchella* was recorded by Butler, in "Proceedings of the Zoological Society of London," 1878, among a small collection of Lepidoptera obtained by the Rev. J. S. Whitmee at the Ellice Islands; also a worn example of a widely distributed moth, *Achæa melicerte*. Amongst those moths obtained by Mr. Woodford as having been obtained by him at the Gilberts in 1884, and recorded by Butler in "Annals and Magazine of Natural History," 5th Series, Vol. xv., pp. 239-242, the following were also taken at Nukufetau, in the Ellice Group:—*Deiopeia pulchella*, *Amyra octo*, *Remigia translata*, *Erihita modestalis*, *Rinecera mirabilis*, and *Harpagoneura complexa*.

COLEOPTERA.

Obs.—Seven species of Coleoptera, which, with the exception of two, were referable to known species, were obtained by Mr. Hedley, and are enumerated below. I am indebted to Mr. George Masters, Curator of the Macleay Museum, and to Mr. T. G. Sloane, for much valuable assistance and information. The following are the known species of Coleoptera obtained from Funafuti:—

FAMILY ELATERIDÆ.

- Monocrepidius ferrugineus*, Montrouz.....One specimen.
Monocrepidius umbraculatus, Cand.....One specimen.

FAMILY TENEBRIONIDÆ.

- Uloma cavicollis*, Fairm.....One specimen.
Uloma insularis, Guer.....One specimen.

FAMILY CALANDRIDÆ.

- Sphenophorus sulcipes*, Karsch.....Four specimens.

* Ann. K.K. Naturhist. Hofmus., viii., 1893, p. 22.

FAMILY CEDEMERIDÆ.

Genus NACERDES, Schmidt.*Nacerdes transmarina*, sp. nov.

(Plate i., fig. 6.)

Long. 14 mm., lat. 4 mm.

Eliptic, elongate, yellowish-brown, thorax narrowed in front and at base, scarcely as long as it is wide.

Head yellowish-brown, obscurely punctate, sparingly clothed with very short and fine yellowish pubescence. Eyes prominent, finely granulated, black. Thorax moderately convex, narrowed in front, truncated, abruptly and strongly bulging out laterally to about one-third its length, thence gradually tapering inwards to its posterior extremity where it is again truncated; disc clothed with very short yellowish pubescence. Elytra somewhat shorter than abdomen, yellowish-brown, moderately arched, obscurely punctate, clothed with short, fine, yellowish pubescence, broadest at the shoulders, gently tapering to abdominal extremity. Mentum small, somewhat concave. Underside concolorous, clothed with exceedingly fine pubescence; sterna obscurely punctate-striate. Legs moderately long, yellow-brown, thickly clothed with short yellowish pubescence, and armed with short black spines at joints. Antennæ, concolorous.

Three specimens.

FAMILY OTIORHYCIDES.

Genus ELYTRURUS, Schönherr.*Elytrurus squamatus*, sp. nov.

(Plate i., fig. 7.)

Long. 4 mm., lat. 2 mm.

Eliptic, robust, bluish-grey; thorax narrowed in front and at base, punctate; elytra, punctate-striate.

Rostrum black, with a broad central shallow depression. Thorax convex, scarcely as broad as long, closely covered with minute shining granules, slightly narrower in front than behind, gradually widening towards the middle, and then narrowing again. Elytra arched, striate-punctate, slightly wider at the shoulders than the thorax at its base, gradually widening towards the middle, thence narrowing again to the apex; the apices acute; the whole surface thickly covered with minute shining granules; there are also a few short hoary hairs towards the apex, and along the sides. The general colour is bluish-grey. Legs and antennæ concolorous, thickly covered with minute shining granules, and furnished with a few short hoary hairs. Antennæ long, slender.

Obs.—This was the most representative species of the series collected, fifteen specimens having been obtained. In some of the members there is a slight difference in colouration, some being brownish-grey, but this is doubtless a sexual distinction. The chief interest attaching to this genus, however, is the fact that it is confined solely to the Pacific Islands. The following are the localities from which representatives have hitherto been obtained:—New Hebrides, New Guinea, Fiji, Tahiti, Vanikoro, and Nukuhiva.

Mr. Woodford, in his paper on "The Gilbert Islands,"* gives the following list of species as obtained by him in that group:—*Amarygmus*, sp., *Pantopæus guisens*, *Coccinella transversalis*, *C. arcuata*, *Necrobia rufipes*, *Tribolium ferrugineum*, *Dermestes*, sp., *Carpophilus*, sp., *Silvanus*, sp., *Carcinops* (?) sp., *Trogosita mauritanica*, *Alphitobius piceus*, *A. diaphanus*, *Sitophilus*, sp., *Adelocera modesta*, *Monocrepidius*, sp., *Nacerdes*, sp. (2), and a genus allied to *Tribolium* (?) sp.

HYMENOPTERA.

Only two species of Hymenoptera were obtained—one a bee, *Megachile*, sp., the other being a few *workers* of a species of ant—*Pheidole sexspinosus* (Mayr). According to Mr. Woodford, "A leaf-cutting-bee of the genus *Megachile* was very common on all the [Gilbert] islands, making its nest under the thatch of the houses, and using portions of the leaves of *Morinda citrifolia* for the construction of its cells."† My colleague, Mr. Hedley, informs me that *Morinda citrifolia* is common on the Island of Funafuti, but he did not notice that it was attacked by the leaf-cutting bees as reported by Mr. Woodford in the Gilberts. Nevertheless the leaves of *Pandanus odoratissimus*, a plant that is also common in the Gilberts, had the appearance of portions having been cut out of them apparently by some leaf-cutting insect.

FAMILY APIDÆ.

Genus MEGACHILE, Latr.

Megachile hedleyi, sp. nov.

(Plate i., fig. 5.)

Long. 11 mm., lat. 4 mm.

Expanse of anterior wings—Long. 7 mm., lat. 3 mm.

„ posterior wings „ 5 „ „ 2 „

* Geogr. Journ., vi., 4, 1895, p. 348.

† Loc. cit., p. 348.

Head, forehead, and cheeks black, clothed with cinerous pubescence; head closely and finely punctured; ocelli prominent; antennæ black; labrum black, closely and finely punctured; ligula and mouth parts ferruginous. Thorax black, finely and closely punctured, sparingly clothed with cinerous pubescence. Abdomen cordate, dorsal surface black, segments fringed with short black hairs; anterior extremity sparingly furnished with short cinerous pubescence, and posterior extremity with black; sides clothed with ferruginous pubescence; ventral surface black, clothed with long reddish hairs, except at posterior extremity where the hairs are shorter and black. Breast black, finely and closely punctured; a few short cinerous hairs are distributed over its surface. Legs black; coxæ and underside of each ambulatory limb clothed with short cinerous hairs; underside of tibiæ and tarsi ferruginous. Wings dark fuscous; veins and nervures black.

Two specimens.

I have very great pleasure in dedicating this species to my esteemed friend and colleague, Mr. Charles Hedley.

FAMILY FORMICIDÆ.

Pheidole sexspinosa, Mayr.....Twelve specimens, all workers.

Dr. Gustav. Mayr described the ♂ and worker of this species in a paper entitled "Neue Formiciden,"* and recorded it "Auf den Ellice-Inseln in grossen Ocean, vom Museum Godeffroy." To his description he appended a note which may be of interest to students, and of which the following is a translation:—

"The genus founded by Mr. Smith, and for which he proposed the name *Pheidoxlacanthinus*, would appear to suit the above species, but there is a difference in the structure of the antennæ. The one named by Mr. Smith has eleven joints, while the antennæ of *Pheidole sexspinosa* has twelve joints."

In Mr. Hedley's memoranda I read the following:—"Several ants occurred in the area of sandy soil near the cultivation grounds, one with a metallic colour could inflict an unpleasant bite upon bare feet." Mr. Woodford says of the Gilbert Islands:—"Three or four species of small ants were common on all the islands, and the firewood taken on board at several places swarmed with them."†

* Verh. K.K. Zool.-bot. Ges. Wien, xx., 1870, pp. 978-9.

† Geogr. Journ., vi., 4, 1895, p. 348.

LEPIDOPTERA.

FAMILY NEPHALIDÆ.

Junonia vellida, Fabr.....One specimen, damaged.

Only one species—and of that a single specimen—of Lepidoptera was obtained, namely *Junonia vellida*. This species with four others, namely, *Euplœa eleutho*, *E. distincta*, *Diadema nerina*, and *D. otaheitea*, were obtained by the Rev. J. S. Whitmee at the Ellice Islands, and was duly recorded in a paper by A. G. Butler, in 1878.* Referring to *J. vellida*, the writer penned the following interesting note:—"Resembles Australian examples, being less suffused with orange-tawny than Samoan specimens." In another paper, entitled "Lepidoptera collected by Mr. C. M. Woodford in the Ellice and Gilbert Islands,"† Mr. Butler records *J. vellida* from Nukufetau (Ellice Group) and Tapetwea (Gilbert Group), and *Hypolimnas rarick* from Tapetwea. Mr. Woodford also refers to the two last-named species in his paper,‡ and states that the larva of *J. vellida* feeds upon *Scævola kœnigii*, and the larva of *H. rarick* on an *Abutilon*. He says that "Of the two species of butterflies, *J. vellida* is generally distributed throughout the Pacific Islands, but *H. rarick*, so far as I know, although found in the Marshalls, does not extend further to the south-east than the Gilbert Group."§

Commenting on the Lepidoptera of the island, Mr. Hedley says:—"Large green caterpillars whose clawed tails proclaimed them of the Sphingidæ were occasionally brought by the natives, and were probably related to a large day-flying hawk-moth, like the European clearwing which was rarely seen, hovering and dashing from tree to tree above the sweep of a butterfly net. Small moths were to be obtained by beating the bushes, and swarmed to our lamp at night through the open sides of our native hut."

DIPTERA.

Amongst the Muscædæ procured four appear to be new to science, and are herewith described and figured. Other specimens obtained at Funafuti were so mangled by the natives who caught them as to be absolutely useless.

Speaking of the flies, Mr. Hedley says:—"They were a great nuisance; they swarmed on the ship's boats as they came ashore, and on their return invaded the vessel, to which they kept for

* Proc. Zool. Soc., 1878, pp. 296-7.

† Ann. & Mag. Nat. Hist. (5), xv., pp. 238-9.

‡ Geogr. Journ., vi., 4, 1895, p. 348.

§ Loc. cit., p. 349.

several days after leaving the land. The mosquitoes of several kinds, larger and smaller, were an intolerable nuisance, not only to the whites but also to the natives. On the lee side of Funafuti neither black nor white could snatch an hour's sleep at night without the protection of curtains. Before civilisation mats were used for this purpose on Funafuti. Writing of Stewart's Islands in 1851, Mr. John Webster says* :—'A screen of fine matting was let down from the ceiling and surrounded my bed to keep out mosquitoes and other noxious insects.' To avoid the mosquitoes the natives often crossed the islet and slept on the windward side. The small islets on the leeward side of the atoll were much freer from these pests, and I have slept there all night in comfort in the open."

Although mosquitoes have been known to the natives of these islands, probably from time immemorial, there is no doubt that some species have been introduced by the agency of traders, for the few brought home by Mr. Hedley show that *Culex hispidosus*, Sk., and *Megarhina inornata*, Walk.—the former common in Australia and the latter in New Guinea—have each taken up their abode in the Ellice Group. The Rev. Dr. W. Wyatt Gill, writing of the mosquitoes in the Hervey Islands,† says :—"There are some islands where this annoying insect was until lately unknown. The old men of Penrhyns, Rakaanga, and Manihiki assure me that no mosquito was ever seen on those atolls until some years after the introduction of Christianity. Although mosquitoes were (accidentally) conveyed to Penrhyns and Rakaanga in 1859, and to Manihiki so lately as 1862, in water-casks filled at Raratonga, they are plentiful in all three islands." Again, Mr. Woodford in his paper on "The Gilbert Islands," says :—"Mosquitoes occurred on some islands ; on others, as at Kuria, I did not notice them."‡

* Looking over Mr. Hedley's memoranda, I read the following interesting note, describing the ingenious method adopted by the natives at Funafuti for the purpose of capturing insects :—"Mosquitoes and other insects were caught thus by the natives : a forked stick was converted into a hoop by tying together the arms of the fork. This was passed over and over through the snares of the orb-weaving spiders till the hoop was filled by a membrane of glutinous spider-threads. By this any insect would be struck and meshed."

So far as fleas are concerned, Mr. Hedley says that notwithstanding the fact that all conditions suitable for their propagation are present, they are unknown at Funafuti.

* Webster—Last Cruise of the "Wanderer," Sydney (n.d.), p. 59.

† Gill—Jottings from the Pacific, 1885, p. 162.

‡ Geogr. Journ., vi., 4, 1895, p. 348.

The following are the species obtained :—

FAMILY CULICIDÆ.

Culex hispidosus, Sk.....Two specimens.

Megarrhina inornata, Walk.....Six specimens.

FAMILY ANTHOMIZIDÆ.

Genus LISPE, Nob.

Lispe vittata, ♀, sp. nov.

(Plate i., fig. 1.)

Long. 5 mm., lat. 1 mm.

Expanse of wings—Long. 4 mm., lat. 2 mm.

Head—occiput black, hairy ; forehead reddish-brown, grey laterally, clothed with black hairs ; eyes, rich mahogany-brown ; ocelli, three ; antennæ, short. Thorax grey, three dark brown longitudinal lines running the entire length, upper surface clothed with short black hairs ; sides furnished with few long coarse black bristles. Abdomen—dorsal surface dull yellowish with black median and lateral markings and patches, clothed sparingly with moderately long coarse black bristles ; sides, pale yellowish with small black patches at junction of segments, and furnished with a few moderately long coarse black hairs. Breast, hairy and ashy-coloured. Legs yellowish, clothed with short black hairs and armed with few short strong spines. Wings covered with hair-like scales, semi-transparent, with brassy reflections.

A single specimen.

FAMILY TACHINARIDÆ.

Genus DEGEERIA, Meig.

Degeeria dawsoni, ♂ et ♀, sp. nov.

(Plate i., fig. 2.)

Long. 8 mm., lat. 3 mm.

Expanse of wings—Long. 4 mm., lat. 2 mm.

Head—occiput black, clothed with black hairs ; forehead black with coarse black hairs or bristles ; cheeks, grey ; eyes, rich mahogany-brown ; ocelli, three ; antennæ, black. Thorax grey, clothed on superior surface with short coarse black hairs or bristles, seven dark grey longitudinal bars run the entire length of pro- and meso-thorax. Abdomen—dorsal surface grey with

black median patches, and black transverse bars at junctions of segments, clothed with few short black hairs; sides yellow-brown, darkest at posterior extremity, sparingly furnished with short black hairs; ventral surface dull white, with two small oblong yellow-brown patches, each patch fringed with short black hairs. Anus, black. Breast, dark brown. Legs black, clothed with black hairs and few short strong spines. Wings covered with hair-like scales, semi-transparent, with brassy reflections.

♂ Copulatory organ, a long telescopic, fleshy, pale yellowish process, consisting of seven segments, the extremity of each segment furnished with long, strong bristles.

One ♂ and three ♀ specimens.

At the request of Mr. Hedley this species is named after W. Pudsey Dawson, R.N., First Lieutenant of H.M.S. "Penguin," who did so much to facilitate the scientific objects for which the expedition was organised.

Genus EBENIA, Nob.

Ebenia nigricruris, ♀, sp. nov.

(Plate i., fig. 3.)

Long. $4\frac{1}{2}$ mm., lat. 1 mm.

Expanse of wings—Long. 4 mm., lat. 2 mm.

Head—occiput black, clothed with black hairs; forehead black with coarse black hairs or bristles; cheeks, grey; eyes, rich mahogany-brown; ocelli, three; antennæ, black. Thorax dark brown, shoulders grey; superior surface clothed with few short black hairs; sides furnished with long coarse bristles. Abdomen black at anterior extremity, second, third, and fourth segments grey, with broad black median transverse bar, the latter uneven in outline; junction of segments black; dorsal surface thinly clothed with moderately long, strong, black hairs; ventral surface dirty white with moderately long black hairs; anus, black. Breast black, with few short black hairs. Legs black, clothed with black hairs, and armed with short strong spines. Wings covered with hair-like scales, semi-transparent, with brassy reflections; veins, black.

A single specimen.

Ebenia fieldi, ♀, sp. nov.

(Plate i., fig. 4.)

Long. $4\frac{1}{2}$ mm., lat. 1 mm.

Expanse of wings—Long. 4 mm., lat. 2 mm.

Head—occiput black, clothed with black hairs; forehead black, with long, coarse black hairs or bristles; cheeks, white; eyes, rich mahogany-brown; ocelli, three; antennæ, black. Thorax grey; two dark longitudinal bars extend from anterior extremity of pro- to near posterior extremity of meta-thorax; few rather long coarse black hairs; sides of a lighter grey colour, and furnished with a few long coarse black hairs. Abdomen, dark, with lateral patches of a light grey colour; posterior extremity black; dorsal surface furnished sparingly with short black hairs; ventral surface grey, and sparingly furnished with short black hairs; anus, black. Breast black, with few short black hairs. Legs black, clothed with black hairs, and armed with few short strong spines. Wings covered with hair-like scales, semi-transparent, with brassy reflections; veins, black.

A single specimen.

By request I have named this species after Captain Mostyn Field, R.N., Captain of H.M.S. "Penguin," as a permanent tribute to his courtesy, and a mark of the sense of indebtedness felt by the members of the Expedition for assistance in many ways.

HEMIPTERA.

A species of *Halobates* was taken by one of the party on a single occasion from a pool between tide-marks. On one occasion at dusk Mr. Hedley saw some *Halobates* in one of the saltwater pools which at high tide appear in the centre of the island, but failed to secure any. Lice were very common and afflicted the natives very much.

ORTHOPTERA.

Although the Libellulidæ are not represented in the collection from Funafuti, Mr. Hedley remarks that a large dragon-fly was a conspicuous object, flashing across the more open spaces in the woodland on sunny days. In the Gilbert Group the three following species are common:—*Anax guttata*, *Pantala flavescens*, *Trithemis bipunctata*.*

So far as the collection under discussion is concerned, this Order is represented by the following species:—

FAMILY LACERSTIDÆ.

Concephalus ensiger (?) Har.....One specimen.

* Geogr. Journ., vi., 4, 1895, p. 349.

FAMILY BLATTIDÆ.

Panesthia æthops, Stoll..... One ♂ et two ♀ specimens.

Loboptera decipiens, Germ..... One specimen.

FAMILY GUILLIDÆ.

Arachnocephalus vestitus, Costa..... One specimen.

PSEUDONEUROPTERA.

TERMITIDÆ.

Calotermes marginipennis, Latr.

Calotermes marginipennis, Latr., Hag. Monogr., p. 47.

Catalogue of Specimens of Neuropterous Insects in the Collection of the British Museum, by Dr. H. Hagen ; Part I., Termitina, p. 7.

Not the least interesting feature of the Insecta from Funafuti is a small collection of White Ants—*Calotermes marginipennis*, Latr.. The localities recorded so far from whence examples have been obtained are California, Mexico, and Hawaii. The Rev. Thomas Blackburn collected it in the Hawaiian Islands, and it was recorded from there by McLachlan in a paper* dealing with Mr. Blackburn's collection.

This species of White Ant confines its attention at Funafuti to the coconut trees (*Cocos nucifera*). The insects generally attack the palms from three to six feet from the ground, tunnelling their way through, and as a result the trees are snapped off by the gales. At night, attracted by the lamps, these insects fly into dwellings. The Rev. Thomas Blackburn in a paper, "Notes on Hawaiian Neuroptera,"† writes:—"I have not met with any more than the two American species recorded in Mr. McLachlan's paper. They are both extremely common near Honolulu, flying in numbers to lamps at night, and doing much damage in the destruction of furniture and other woodwork, also frequently destroying trees. Without having given sufficient attention to the subject to generalize with absolute confidence, I may say that *Termitia* connected with household depredations, when identified by me, has always been *Calotermes castaneus*, Burm. (which, however, I have never observed outside Honolulu), while the tree

* Ann. & Mag. Nat. Hist., (5), xii., pp. 266-7.

† Loc. cit. (5), xiv., p. 413.

devastator when identified by me has always been *C. marginipennis*, Latr. This latter species I have observed on several of the islands."

The headquarters of *Calotermes*, as indeed the Termitidæ as a whole, is Tropical America, more species having been recorded from Brazil than any other part of the globe, and from whence many have distributed. Arguing from the same premises, Tropical America would appear to be the home of the *Cocos* tribe, the majority of its species being found within that zone. In discussing this question, Mr. W. Botting Hemsley says* :—"De Candolle states† he formerly believed it to have spread from Western America, but with fuller data and more experience in such questions, he inclines to the opinion that its original home is the Indian Archipelago ; but as the thirty other species belonging to the genus are restricted to Tropical America, the first opinion seems the sounder." It is quite probable that *Cocos nucifera*, being an introduced plant into the Islands of the Pacific, the insect that proves so destructive to it, may also have been introduced, if not actually with, at any rate at no late date after its introduction. The distribution and association of this species of Termitid, with its host plant, therefore affords an interesting study when considered in the light of faunistic distribution, coming as it did, originally from Mexico and California. From the early days of settlement in California, the Hawaiian Islands have been a centre of commercial enterprise with the Californians, and it is possible therefore that *Calotermes marginipennis* may have been introduced in Hawaii by human agency, and that when swarming numbers of these destructive insects may have been wafted from island to island. The coconut palm was first introduced into the Ellice Group during the reign of King Touassa, somewhere about two centuries ago. During the period intervening, and up to more recent times, the islands were frequently visited and raided by neighbouring islanders (see pp. 44 and 45 of Part I. of this Memoir) ; besides this the Ellice Group was the field of a great whaling fishery in the early forties, and this industry was pursued chiefly by Americans, who not only visited the group, but also other islands of the Pacific from Hawaii onwards, so that, taking all these facts into consideration, it is quite reasonable to suppose that this, and other species of insects, may have been introduced by the agency of man. It is unfortunate, considering its many important bearings, that the fauna of the Pacific Islands has not been more thoroughly worked ; when it is, however, the distribution of species—both fauna and flora—will doubtless form one of the most interesting and instructive lessons of modern biological investigation.

* Challenger Reports—Botany, i., 2, 1885, p. 203.

† De Candolle—Origin des Plantes Cultivées, p. 350.

MYRIAPODA.

FAMILY CHILOPODA.

Scolopendra platypus, Brandt.....Two specimens.

Centipedes were fairly common on the island, and were apt to creep into and hide amongst the folds of any unworn titi dresses. If such clothes had been laid aside, it was necessary before using to have them carefully fumigated. This was done by placing a handful of "Gnashu" (*Scaevola*) leaves on some embers around which the titi dresses were arranged, and a couple of mats were packed round to keep the smoke in. Karsel and Finch* recorded *S. platypus*, Brandt, *Orphnæus lividus*, Mein., and *Otostignus orientalis*, Por., from the Marshall Group in 1880.

* Berlin. Ent. Zeit., xxv. p. 15.

THE ARACHNIDAN FAUNA OF FUNAFUTI.

By W. J. RAINBOW,

Entomologist, Australian Museum.

[V.]

THE ARACHNIDAN FAUNA.

BY W. J. RAINBOW,

Entomologist, Australian Museum.

THE Arachnological Collection obtained by Mr. Hedley during his sojourn on the Island of Funafuti, although not large, is, nevertheless, more representative of its branch of Invertebrate Fauna than was the Entomological Collection. Had it been possible to have made a thorough and systematic search, there is little doubt but that many interesting forms would have been brought to light. As it is, however, the collection is not without interest, and it is hoped, value. In all there were 88 specimens procured, and these are distributed as follows:—

Order.		Family.		No. of Specimens.
Scorpionidæ	..	Androctonidæ	...	4
Chelonethi	...	Cheliferidæ	...	8
Acarina	...	Oribatidæ	...	14
Araneidæ	...	Epeiridæ	...	32
"	...	Tetragnathidæ	...	1
"	...	Uloboridæ	...	12
"	...	Drassidæ	...	3
"	...	Scytodæ	...	3
"	...	Thomisidæ	...	4
"	...	Salticidæ	...	7
Total ...				88

Of these the following table will show the results of the examination of the collection:—

Order.		Family.	Known Species.	New Species.
Scorpionidæ	...	Androctonidæ	0	1
Chelonethi	...	Cheliferidæ	1	1
Acarinæ	...	Oribatidæ	0	1
Araneidæ	...	Epeiridæ	2	10
"	...	Tetragnathidæ	1	0
"	...	Uloboridæ	1	0
"	...	Drassidæ	1	0
"	...	Scytodæ	1	0
"	...	Thomisidæ	2	0
"	...	Salticidæ	1	2
Total ...			10	15

It will be seen, therefore, that of the twenty-five species obtained, fifteen would appear to be new to science. The most numerous family in the collection is that of the Epeiridae (known to the natives by the name of "Marakau"), of which two species proved to be known, and ten appear to be new. Of the former *Epeira mangareva*, Walck., has a very wide distribution, extending from the Celebes to New Guinea, and from there to the Island of Mangareva, in the Paumotu or Low Archipelago; the other, *E. plebeja*, L. Koch, was previously recorded by L. Koch from Ovalau and Tonga.* One of the principal features that strikes a student upon examining a collection of Island (female) Epeiridae, is the close resemblance the different species bear to one another in shape and contour of the epigynum. In the two species enumerated as previously known, and in each of those described below, with three exceptions, namely, *E. distincta*, Rainb., *E. hoggi*, Rainb., and *E. speciosa*, Rainb., the same general uniformity prevails. There are differences, truly, as will be seen on reference to the figures accompanying this paper; thus in one species, the long dark brown, slightly curved chitinous process is closely adpressed, while in another it is poised upon a high tubercle and stands prominently out.

The commonest spider on the Island appeared to be *Uloborus zosis*, Walck. This beautiful Arachnid possesses a very wide geographical range, having been previously recorded from Madagascar, Mauritius, Réunion, Seychelles, St. Helena, Bombay, Java, Amboina, Upolu, Pernambuco, Paraná, Rio Grande, Guyana, St. Fe di Bogotà, and the Antilles.†

The other previously known species were formerly recorded as follows:—*Obisium antiodum*, Sim., from New Caledonia; *Tetragnatha laqueata*, L. Koch, Upolu; *Clubiona alveolata*, L. Koch, Upolu; *Dictus striatipes*, L. Koch, Upolu, Tonga, and Viti; *Acompse suavis*, L. Koch, Huaheine, Raiatea, and Tahiti; *Sarotes debilis*, L. Koch, Upolu; *S. regius*, Fabr., is another species having a very wide geographical range, as the following list of localities will testify: Singapore, China, Japan, Africa, Dafeta; Mombus, Zanzibar, Isle of France, Senegal, St. Thomas, California, Mexico, Martinique, Brazil, Valparaiso, Fiji, Samoan Archipelago, Tongan Archipelago, Rarotonga, Pelew, Tahiti, Huaheine, Island of Meduro, and New Caledonia. In addition to the species enumerated, there were ten specimens of Epeiridae, and four of the Salticidae, that were too young for determination or description, and these have not been enumerated in the tables.

* Koch—Die Arachniden Australiens, i., p. 70, 1871.

† Vide Thorell, "Studi Sui Ragni," etc., ii. "Ragni di Amboina," p. 133. 1878.

Order SCORPIONIDÆ.

FAMILY ANDROCTONIDÆ.

SUB FAMILY ANDROCTININI.

Genus BUTHUS, Leach.

Buthus brevicaudatus, ♂ et ♀, sp. nov.

(Plate ii., figs. 1, 1a, 1b, 1c.)

Colour somewhat variable, but generally of an obscure yellowish grey above, and pale yellowish underneath; sides dull brown; palpi brown above, yellow-brown underneath; tail dark brown above and laterally, somewhat paler underneath; vesicle pale yellow, glossy; aculeus brown, glossy; eyes black; legs obscure yellow above, pale yellowish underneath.

Cephalothorax as wide behind as it is long, gradually narrowing until near anterior extremity, and thence narrowing off abruptly to anterior margin; anterior and posterior margins strongly indented; a strong longitudinal groove runs down the centre from anterior to posterior extremity, and separates the median eyes; these latter are slightly elevated on small tubercles; the surface is closely and minutely punctured, somewhat uneven and depressed at centre, but more strongly so behind the median eyes; there are also shallow lateral depressions at rear of anterior eyes; behind the median eyes, and at the anterior margin there are a few small granules; in the male the anterior margin is more thickly granulated than in the female examples; a few short hairs fringe the anterior line of the cephalothorax. Tergites finely punctured, but the punctures are somewhat deepest laterally; each is marked with a median keel. Sternites smooth, glossy, with shallow lateral and median depressions, closely and minutely punctured; each is marked with a median keel. Tail short, almost parallel-sided; the first segment is somewhat the shortest, the second and third rather longer and co-equal in length, the fourth and fifth slightly longer than the two preceding and co-equal in length; each segment is keeled laterally, has a median longitudinal depression, and is slightly shagreened and granulated above and laterally; the inferior surface is less distinctly keeled, but more strongly shagreened and granulated, the fifth segment especially so; each segment is sparingly furnished with rather long, strong brown hairs. Vesicle smooth and glossy, furnished with a few moderately long yellowish hairs; aculeus dark brown, strong, and gently curved; vesicle and aculeus together are somewhat longer than the fifth caudal segment. Palpi: superior surface of humerus, brachium, and manus thickly but finely granulated, the granules on their lateral and anterior and posterior extremities are sensibly

the largest and darkest; lower surface exceedingly finely granulated with the exception of the lateral ridges, where the granules are nearly as large as those upon the lateral extremities of the superior surface; manus long, broad, and thicker than brachium; hand-back keeled, similar in colour to superior surface, and thickly furnished with black granules; fingers short, black, incurved, without lobe or excavation; the movable finger is somewhat the longer; humerus, brachium, and manus sparingly furnished with short, fine whitish hairs. Legs sparingly furnished with yellowish hairs, upper surface finely granulated, under surface smooth and glossy. Pectines about half as long as cephalothorax, and furnished with six teeth.

The sexes are distinguished by the palpi, which in the male are longer, broader, and thicker than in the female.

Measurements (in millimeters):—Total length, 27; length of cephalothorax, $3\frac{1}{3}$; width, in front 2, behind $3\frac{1}{3}$; length of tail, 10; length of male humerus $3\frac{1}{2}$, of brachium $3\frac{1}{2}$, of hand 6, of hand-back 6, of moveable finger 4; width of male humerus $1\frac{1}{2}$, of brachium 2, of hand $3\frac{1}{2}$, of hand-back $1\frac{1}{2}$; length of female humerus 3, of brachium 3, of hand 5, of hand-back 5, of moveable finger 3; width of female humerus 1, of brachium $1\frac{1}{2}$, of hand 3, of hand-back $1\frac{1}{2}$.

One male and three female specimens.

Order CHELONETHI.

Sub-Order DIPLOCELONTHI.

FAMILY CHELERIFIDÆ.

Obisium antipodum, Simon.....Six specimens.

C.R. Ent. Belg., xxiii., p. clxxiv.

Genus CHELIFER, Geoffr.

Chelifer longidigitatus, sp. nov.

(Plate ii, fig. 2.)

Body obovate, narrowed before, rounded behind. Caput dark brown, granulated. Cephalothorax granulated; anterior segment dark brown, hinder segment pale yellowish above, brown laterally. Eyes prominent, and of an opaline tint. Legs pale yellowish, moderately clothed with short white hair. Palpi dark brown, granulated; basal joints bulbous; hand broad, thick, slightly darker than humerus and brachium; fingers long, reddish-brown, incurved, and furnished with a few elongated, flexible hairs. Abdomen pale yellowish above, with brown submedian and

lateral granulations ; inferior surface pale yellowish, with two longitudinal sub-median rows of brown granulations.

Measurements :—Length of body, $1\frac{1}{2}$ mm. ; breadth, 1 mm. ; palpi, 2 mm.

Two specimens.

Order ACARINA.

FAMILY ORIBATIDÆ.

Genus ORIBATA, Lat.

Oribata lamellata, sp. nov.

(Plate ii., figs. 3, 3a, 3b, 3c, 3d.)

Cephalothorax, $\frac{1}{2}$ mm. long ; abdomen, 1 mm. long, 1 mm. wide.

Black, opaque ; tergum laminated ; venter somewhat rugulose, closely punctated.

Cephalothorax arched, closely and deeply punctated ; anterior half conical, posterior half suddenly widening ; rostrum round pointed ; rostral hairs long ; palpi invisible from the dorsal aspect ; pseudo-stigmata nearly at the base of the cephalothorax, but not hidden by the abdomen or lamellæ ; pseudo-stigmatic organ rather short, with thin peduncles ; the latter gradually thickening and terminating with somewhat clavate heads ; apodemata not joined to the sternum. Legs strong, closely and finely punctated, furnished with short, strong white hairs ; claws tridactyle, heterodactyle. Abdomen strongly arched, somewhat oval, closely punctated, laminated, the plates overlapping, broadest about the middle, strongly keeled behind ; genital and anal plates large, oval, and occupying nearly the whole length of the ventral plate.

In respect of this creature Mr. Hedley says :—"On the western side of the north arm of the mangrove swamp is a low scarp of breccia, apparently an old beach, and which is described more fully in the Section treating on the Geology of the Atoll. A dense growth of *Ngia* (*Pemphis acidula*) overhung this spot, and under fallen damp leaves and sticks beneath these bushes I found this animal in considerable abundance. Its movements were lethargic in the extreme."

Order ARANEIDÆ.

FAMILY EPEIRIDÆ.

Epeira mangareva ♀ Walck... ..One specimen.

Walck. Hist. Nat. des. Ins. Apt., iv., p. 469, 1847.

L. Koch, Die Arachniden Australiens, i., pp. 85-88, T. vii., figs. 4-5a, 1871.

Bradley, Proc. Linn. Soc. N.S.W., i., The Araneides of the "Chevert" Expedition, pp. 144-5, 1876.

Thor., Studi Sui Ragni, etc., i. Ragni di Sèlebes, *loc. cit.*, p. 394 (54), 1877.

Thor., Studi Sui Ragni, etc., ii., Ragni di Amboina, *loc. cit.*, pp. 65-69, 1878.

Epeira plebeja, Koch.....Three immature specimens.

L. Koch, Die Arachniden Australiens, i., pp. 69-70, T. vi., figs. 10, 10a, 1871.

Genus EPEIRA, Walck.

Epeira ventricosa, sp. nov.

(Plate ii., figs. 4, 4a, 4b, 4c.)

♀. Cephalothorax, $4\frac{1}{2}$ mm. long, 3 mm. broad; abdomen, $10\frac{1}{2}$ mm. long, $7\frac{1}{2}$ mm. broad.

Cephalothorax convex, hairy, yellowish, with median and lateral brown longitudinal bars. Caput moderately high, truncated in front, clothed with moderately long hoary hairs; normal grooves and indentations distinct. Clypeus clothed with short hoary hairs, convex, with lateral grooves radiating from near the centre. Marginal band narrow, yellowish, fringed with hoary hairs. Eyes of an opaline tint; the four comprising the central group are seated upon a somewhat quadrangular tubercle, and form a trapezium, narrowest at the rear; of these the front pair are the largest, and are separated from each other by about twice their individual diameter; the second pair are smaller and are seated to the rear by about twice, and from each other by about once-and-a-half their individual diameter; lateral eyes much the smallest, seated obliquely upon small tubercles, and are almost contiguous to each other. Legs moderately long and strong, with black and yellow annulations, hairy, armed with rather long and strong spines; relative lengths, 1, 2, 4, 3; the second and fourth pairs equal in length, the third much the shortest. Palpi moderately long and strong, similar in colour and armature to legs. Falces long and strong, glossy brown in front and on outer sides; insides pale yellow, fringed at their base with a few short hoary hairs; the margins of the furrow of each falx are armed with a row of three teeth; fangs moderately long and strong, wine-red. Maxillæ rather longer than broad, arched; from base to near apex the colour is brown, thence yellowish; fringed with moderately long and strong black hairs. Labium concolorous, broader than high, rounded off at apex. Sternum shield-shaped, dark brown, approaching bistre, relieved by a longitudinal median line of yellow; surface uneven, hairy. Abdomen ovate, projecting over base of cephalothorax; superior

surface dark, approaching bistre, ornamented with white and grey median patches, and with a broad leaf-like design; sides dark brown also, with a broad uneven longitudinal patch of grey near superior surface, and below this a series of irregular tawny markings; inferior surface sooty black with four white lateral patches. Epigyne a long dark brown chitinous process, terminating in a blunt point.

One specimen.

Epeira longispina, ♂ et ♀, sp. nov.

(Plate iii., fig. 2.)

♂. Cephalothorax $2\frac{1}{2}$ mm. long, 2 mm. broad; abdomen 5 mm. long, $3\frac{1}{2}$ mm. broad.

Cephalothorax pale yellow, clothed with hoary hairs; the median and lateral longitudinal markings less distinct than in the female. Caput slightly elevated, arched. Clypeus broad, strongly arched, clothed with long hoary hairs, the median cleft, from which the lateral grooves radiate, more distinct than in female example. Marginal band, eyes, and legs similar to those of female. Palpi short, club-shaped, simple. Maxillæ, labium, and sternum similar to those of female. Abdomen ovate, slightly overhanging base of cephalothorax; colour mottled grey; the broad leaf-like design with which the superior surface is ornamented, is of a dark brown colour, and commences near the middle, terminating near spinnerets; the sides, inferior surface and spinnerets similar in coloration and general features to those of the female.

One specimen (immature).

(Plate iii., figs. 1, 1a, 1b.)

♀. Cephalothorax, $4\frac{1}{2}$ mm. long, 3 mm. broad; abdomen, 6 mm. long, 4 mm. broad.

Cephalothorax pale yellow with median and lateral yellow-brown longitudinal markings, and clothed with long hoary hairs. Caput moderately elevated, rounded on the sides and upper part, normal grooves and indentations distinct. Clypeus broad, strongly arched, clothed with moderately long hoary hairs; there is a deep longitudinal cleft or groove in the centre, from whence the lateral grooves radiate. Marginal band moderately broad, glossy, and fringed with short hoary pubescence. Eyes reddish-brown with black rings, the central group forming a trapezium; of these, the two eyes that constitute the front row are sensibly the largest, and are separated from each other by about once their individual diameter; those of the second row are separated from the first by about once their individual diameter, and from each other by a space equal to about two-thirds of the diameter of an eye of the

second row ; the lateral pairs are much the smallest of the group, are seated obliquely on small tubercles, and are almost contiguous. Legs long, moderately strong, pale yellow with yellow-brown annulations at ultimate extremity of joints ; the limbs clothed with pale yellowish pubescence, and armed with long, strong black spines ; relative lengths : 1, 2, 4, 3 ; of these the second and fourth pairs of legs are co-equal in length, and the third pair the shortest. Palpi similar in colour and armature to legs. Falces glossy, pale yellow, somewhat darkest at base ; the upper margin of the furrow of each falx armed with a row of four teeth, and the lower margin with three. Maxillæ pale yellowish, strongly arched, broader at apex than base, sparingly clothed with long black hairs. Labium of a dull obscure colour, broader than long, arched, and rounded off at apex. Sternum oblong-cordate, concolorous, clothed with short hoary pubescence. Abdomen oblong-ovate, projecting over base of cephalothorax, pale yellow, ornamented with a long leaf-like design and dark markings and dots ; sides pale yellow also, with yellow-brown markings and dots ; inferior surface pale yellow with a broad median patch of dark brown, the patch broader at its anterior than at its posterior extremity, and narrowest at the middle. Spinnerets long, prominent. Epigyne a long, glossy, dark-brown chitinous protuberance, terminating in a blunt point, slightly curved, hollowed out on the under-side, and clothed on its upper side with long dark hairs.

A single specimen.

Epeira multispina, ♂ et ♀, sp. nov.

Plate iii., figs. 4, 4a, 4b, 4c.

♂ Cephalothorax, $3\frac{1}{2}$ mm. long, 3 mm. broad ; abdomen, 4 mm. long, 3 mm. broad.

Cephalothorax pale yellow, clothed with moderately long hoary hairs. Caput slightly elevated, moderately arched, truncated in front, normal grooves indistinct. Clypeus broad, arched, pale yellow, with broad obscure lateral bands, and clothed with moderately long hoary hairs ; there is a deep longitudinal cleft (having the appearance of a fine black line) commencing at junction of cephalic and thoracic segments, from whence radiate the lateral grooves. Marginal band narrow, fringed with fine hoary pubescence. Eyes of an opaline tint with black rings, the four comprising the median group forming a trapezium ; of these the front eyes are the largest, and are separated from each other by about once their individual diameter ; those in the second row are somewhat smaller, and are separated from the front pair by a space equal to about one diameter of an eye of the second row, and from each other by a space equal to one-half a diameter ;

lateral eyes minute, seated obliquely on tubercles and contiguous to each other. Legs pale yellow, clothed with yellowish pubescence, and armed with long black spines; relative lengths: 1, 2, 4, 3. Palpi pale yellow, clothed with yellowish pubescence and long black bristles; copulatory organs dark brown, complicated in structure. Falces pale yellow, divergent, clothed with yellowish pubescence; fangs glossy, dark brown at base, wine-red at points. Maxillæ glossy, pale yellow, arched, inclining inwards, fringed with long, coarse hairs at sides and ultimate extremities. Labium somewhat darker, arched, broader than long, furnished with a few moderately long yellowish hairs. Sternum cordate, moderately convex, pale yellowish at its centre, darker laterally, clothed with yellowish pubescence. Abdomen ovate, overhanging base of cephalothorax, pale yellowish, with dark brown leaf-like pattern down the centre, and clothed with long, coarse, yellowish hairs; sides yellowish, with dark brown markings, and long, coarse yellow hairs; inferior surface pale yellow, with dark brown median patch, broader in front than behind, narrowest at the centre. Spinnerets long, prominent.

One specimen.

(Plate iii., figs. 3, 3a, 3b, 3c.)

♀. Cephalothorax, 5mm. long, 3mm. broad; abdomen, 9mm. long, 6½mm. broad.

Cephalothorax convex, hairy, yellowish, with median and lateral dark brown longitudinal bars. Caput moderately high, truncated in front, rounded on the sides and upper part, normal grooves distinct, thickly clothed with coarse hoary hairs. Clypeus broad, strongly arched, clothed with long, coarse hoary hairs; a deep longitudinal cleft, situated at junction of cephalic and thoracic segments from whence radiate the lateral grooves. Marginal band broad, fringed with pale yellowish pubescence. Eyes of an opaline tint with black rings; the four central eyes are seated upon a somewhat quadrangular eminence, and form a trapezium; of these, the two forming the front row are the largest of the group, and are separated from each other by a space equal to once their individual diameter; the second row are somewhat smaller than those of the first, and are separated from the latter by rather more than one diameter of an eye of the second row, and from each other by a space equal to about two-thirds of a diameter; lateral eyes seated on small tubercles and contiguous to each other. Legs long and strong, pale yellow with dark brown annulations at ultimate extremities of joints; in addition to the annulations referred to, the femurs of the first and second pairs of legs have each a long, dark brown patch on the outer surface; limbs clothed with short yellowish pubescence, and armed with numerous

long and strong black spines; relative lengths: 1, 2, 4, 3; the second and fourth pairs co-equal, and the third the shortest. Palpi moderately long, clothed with yellowish pubescence and long black hairs; colour and armature similar to legs. Falces pale yellowish, somewhat darker at base, divergent, inner margins at the base fringed with yellowish pubescence; the upper margin of the furrow of each falx armed with a row of four teeth, and the lower with a row of three; fangs long, strong, glossy, brown at base, wine-red at points. Maxillæ widely divergent, obscurely tinted at base, pale yellowish above, moderately arched, fringed on the outer and inner margins with white and a few long black hairs. Labium concolorous, broader than long. Sternum cordate, moderately convex, dark brown, with a pale yellowish median wedge-shaped patch, broadest in the front, clothed with long, fine yellowish and a few black hairs. Abdomen ovate, yellowish-grey, clothed with short yellowish pubescence; projecting over base of cephalothorax; the broad leaf-like design upon superior surface darkest laterally; sides somewhat lighter in colour; inferior surface grey with a median patch of dark brown, the latter broader in front than behind, and indented laterally with pale yellowish, and this again bordered with dark brown. Spinnerets long and prominent. Epigyne, a long and slightly curved chitinous process, dark brown laterally, yellowish on the upper surface, and fringed with long, yellowish hairs above, and hollowed on the underside; at the base of this process there is a large and somewhat globose fleshy lobe, hollow within, the lobe of a dirty yellowish colour.

One specimen.

Epeira etheridgei, sp. nov.

(Plate iii., figs. 5, 5a, 5b, 5c.)

♀. Cephalothorax, 4mm. long, 3mm. broad; abdomen, 7mm. long, 5½mm. broad.

Cephalothorax pale yellow, with median and lateral longitudinal brown bars; the median bar oblong wedge-shaped, broadest in the vicinity of the median eye, and terminating in a fine point immediately below the junction of the cephalic and thoracic segments, the whole surface of the cephalothorax clothed with long hoary hairs. Caput moderately high, truncated in front, rounded on the sides and upper part. Clypeus broad, strongly arched; a strong, deep longitudinal cleft at the centre, from whence radiate the lateral grooves. Marginal band broad, pale yellow, fringed with short yellowish pubescence. Eyes as in female example of *E. multispina*, Rainb. Legs long and strong, yellow with brown annulations; each limb clothed with yellow and black hairs, and armed with long, strong black spines; relative

lengths: 1, 2, 4, 3; the second and fourth pairs co-equal in length, and the third much the shortest. Palpi moderately long and strong, similar in colour and armature to legs. Falces yellow, fringed on inner side with few moderately long hoary hairs, divergent at apex; the upper margins of the grooves of the furrow of each falx armed with four teeth, and the lower with three; fangs long and strong, dark brown at base, wine-red at tips. Maxillæ widely divergent, arched, obscurely tinted at base, pale yellowish at apex, outer margins fringed with long coarse black hairs. Labium concolorous, arched, broader than long. Sternum cordate, dark brown, clothed with moderately long, hoary hairs. Abdomen ovate, projecting over base of cephalothorax, clothed with short whitish hairs, superior surface yellowish-grey; the broad leaf-like design much the darkest laterally; sides clothed with short whitish hairs, yellowish-grey towards superior surface, somewhat darker below, especially towards posterior extremity; inferior surface dark grey, clothed with short, yellowish hairs; there is also a median patch of dark brown, slightly broader behind than in front, and indented laterally with two white patches; two white spots are located on each side of spinnerets, of which the front pair are considerably the largest. Spinnerets long and prominent, obscure yellowish-brown, and clothed with rather long black hairs. Epigyne seated on a pale fleshy lobe; the long chitinous process similar in colour and structure to *E. multispina*, Rainb.

One mature and one immature specimen. The latter is smaller and much lighter in colour than the former, and the longitudinal median and lateral bars, so prominent on the cephalothorax of the adult, are not present; the same remark also applies to the dark annulations upon the legs and palpi of the adult form.

I have much pleasure in dedicating this species to Mr. R. Etheridge, Junr., Curator of the Australian Museum.

Epeira festiva, sp. nov.

(Plate iv., figs. 1, 1a, 1b.)

♀. Cephalothorax, 4mm. long, 3mm. broad; abdomen, 8½mm. long, 6mm. broad.

Cephalothorax yellow-brown with broad longitudinal median and dark brown bars; the entire surface clothed with coarse hoary hairs. Caput elevated, truncated in front, normal grooves distinct. Clypeus broad, arched, and has a deep median depression, from whence radiate lateral grooves, the latter indistinct. Marginal band broad, pale yellowish, fringed with hoary pubescence. Eyes of an opaline tint, with black rings; the four comprising the central group seated upon a somewhat quadrangular eminence, and form a trapezium; of these the eyes comprising the front row

are the largest of the group, and are separated from each other by a space equal to about one-and-a-half their individual diameter; those of the second row are somewhat smaller and are separated from their front neighbours by a space equal to about two-and-a-half their individual diameter, and from each other by a space equal to once their individual diameter; lateral eyes much the smallest, placed obliquely on small tubercles, and contiguous to each other; of these the front lateral eyes are somewhat the largest. Legs long and strong, with yellow and dark brown annulations; each limb clothed with long yellow and black hairs, and armed with moderately long, strong black spines; relative lengths, 1, 4, 2, 3. Palpi similar in colour and armature to legs. Falces long, strong, divergent at apex, glossy, dark brown, inner margins yellow-brown, and fringed with rather long yellowish hairs; the margins of the furrow of each falx armed with a row of three teeth; fangs long, dark brown at base, wine-red at points. Maxillæ long, broad, moderately arched, divergent, dark-brown at base, flesh-coloured at apex; inner margins thickly fringed with fine yellowish hairs; a few white hairs on outer surface. Labium arched, short, broad, dark brown, approaching bistre. Sternum concolorous, shield-shaped; surface uneven, slightly depressed at centre, sparingly clothed with hoary hairs. Abdomen ovate, projecting over base of cephalothorax; superior surface ornamented with a long, narrow, whitish leaf-like design at centre, with broad lateral dark brown sinuous bands flecked with white, immediately below which there is on each side a dull white sinuous band; superior surface and sides sparingly clothed with short whitish hairs; sides and inferior surface dark-brown with white markings. Spinnerets long, prominent, yellow-brown. Epigyne seated upon a high, pale fleshy lobe; the long chitinous process similar to *E. multispina*, Rainb.

One specimen.

Epeira obscura, sp. nov.

(Plate iv., figs. 2, 2a, 2b, 2c.)

♀. Cephalothorax 4mm. long, 3mm broad; abdomen, 6mm. long, $4\frac{1}{2}$ mm. broad.

Cephalothorax yellow, with broad median and lateral longitudinal dark brown bars, uneven in outline. Caput arched, truncated in front, clothed with long white and dark brown hairs, normal grooves distinct. Clypeus broad, arched; there is a deep longitudinal cleft commencing near junction of cephalic and thoracic segments, from whence radiate lateral grooves, the latter faintly discernable. Marginal band broad, yellow, fringed with a few short yellowish hairs. Eyes similar to female example of *E. multispina*. Legs long and strong, yellow, with dark brown annulations, clothed with long, black and yellow hair,

and armed with numerous long black spines; relative lengths, 1, 2, 4, 3; the second and fourth pairs somewhat shorter than the first, and co-equal in length; the third pair much the shortest. Falces moderately long, obscure yellowish, divergent at apex, inner margins fringed with long yellowish hairs; the upper margin of the furrow of each falx armed with four teeth, and the lower with three. Maxillæ long, arched, widely divergent; outer margins fringed with long black hairs, and the inner with yellowish; colours: dark brown, apex and inner margins of each pale yellow. Labium broader than long, dark brown, apex pale yellow. Sternum cordate, dark brown, hairy. Abdomen overhanging base of cephalothorax; superior surface clothed with pale yellowish hairs; colour: dark brown, flecked laterally with yellow; a long, broken, uneven yellowish patch at centre, commencing at anterior extremity, and terminating about midway; sides dark brown, streaked with yellow; inferior surface dark brown, with yellow lateral patches, and clothed with dark brown and yellowish hairs. Spinnerets long, prominent, yellow-brown, clothed with coarse black hairs. Epigyne elevated on a pale fleshy lobe, the latter cleft deeply and longitudinally in front; the long chitinous process similar to *E. multispina*, Rainb.

One mature and two immature specimens.

Epeira annulipes, sp. nov.

(Plate iv., figs. 3, 3a, 3b, 3c.)

♀. Cephalothorax, 4mm. long, 3mm. broad; abdomen, 8mm. long, $4\frac{1}{2}$ mm. broad.

Cephalothorax convex, hairy, with pale yellow and dark brown longitudinal bars. Caput moderately high, strongly arched, truncated in front, clothed with long hoary hairs; normal grooves distinct. Clypeus broad, arched, clothed on upper part with long hoary hairs, and on the sides with short white and brown hairs; at the centre, commencing at junction of cephalic and thoracic segments there is a deep, longitudinal, moderately long cleft; lateral grooves somewhat indistinct. Marginal band, pale yellow, fringed with short hoary pubescence. Eyes of a greyish lustre with black rings; the four comprising the central group are seated on a slightly elevated quadrangular eminence, and form a trapezium; of these the front pair are slightly the largest, and are separated from each other by a space equal to one and a half their individual diameter; those of the second row are separated from their anterior neighbours by a space equal to twice their individual diameter, and from each other by about one diameter; side eyes seated obliquely on small tubercles, and contiguous to each other. Legs long and strong; coxæ dark brown above, greyish underneath; femurs yellow, with dark brown annulations above, white underneath; trochanters, tibia, and metatarsi

grey, with dark brown annulations; each limb armed with long, strong, black spines; in addition to the latter there are also a few short black spines on the femoral joints; relative lengths, 1, 2, 4, 3—the second and fourth pairs somewhat shorter than the first pair, but co-equal in length. Palpi similar in colour and armature to legs. Falces long, glossy, dark brown, approaching bistre; inner margins yellow, divergent at apex, fringed with rather long hoary hairs on the inner margins; the upper margin of the furrow of each falx is armed with a row of four teeth, and the lower with three; fangs, long, strong, dark brown at base, wine-red at points. Maxillæ broad, divergent, moderately arched, dark brown at base, yellowish at apex and inner margins; a few short hoary hairs on the outer surface, inner margins thickly fringed with yellowish hairs. Labium broader than long, dark brown at base, yellowish at apex. Sternum cordate, shiny, moderately convex; colour: black, with a pale yellowish median streak commencing in front, and running to about two-thirds its length. Abdomen oblong-ovate, projecting over base of cephalothorax, strongly arched, clothed with moderately long, fine hairs; anterior portion and sides light grey, with dark brown markings; from the centre to posterior extremity there is a dark yellowish-brown patch, sinuous laterally; inferior surface dark brown laterally; at the centre there is a broad brownish-grey patch extending from epigyne to near the spinnerets, from which it is separated by a rather broad transverse greyish bar; on each side of the patch there is a longitudinal band of white, narrowest at the centre. Epigyne a long chitinous process, yellowish-brown above, and clothed with rather long dark hair, dark brown laterally, and grooved underneath; the process elevated on a small, broad white fleshy eminence.

One mature and one immature specimen.

Epeira distincta, sp. nov.

(Plate iv., figs. 4, 4a, 4b.)

♀. Cephalothorax, 4mm. long, 3mm. broad; abdomen, 10mm. long, 7mm. broad.

Cephalothorax pale yellow with long narrow longitudinal dark brown bars; the whole surface clothed with long, coarse hoary hairs. Caput arched, slightly elevated, truncated in front; normal grooves distinct. Clypeus strongly arched; a deep longitudinal cleft or groove commencing at base of cephalic and thoracic segments; lateral grooves fairly distinct. Marginal band broad, fringed with yellowish hairs, of which those in front are much the shortest. Eyes pearl-grey lustre with black rings; the four comprising the central group form a trapezium, and of

these the eyes of the front pair are sensibly the largest, and are separated from each other by a space equal to about once their individual diameter; the eyes comprising the second pair are separated from their anterior neighbours by a space equal to once the diameter of an eye of the second row, and from each other by a space equal to about two-thirds of a diameter; side eyes seated obliquely on small tubercles and contiguous to each other. Legs long and moderately strong, yellowish-grey with yellow-brown annulations, clothed with yellowish hairs, and armed with long black spines; relative lengths, 1, 2, 4, 3; the second and fourth pair somewhat shorter than the first, and co-equal. Palpi similar in colour and armature to the legs. Falces long, divergent at apex, shiny, yellowish, inner margins fringed with yellowish hairs; apex dark brown on inner margins; the upper margin of the furrow of each falx is armed with a row of four teeth, and the lower with three. Maxillæ broad, arched, yellow-brown, widely divergent; the outer lateral surface is thinly fringed with yellowish hairs, and the inner lateral surface thickly so. Labium concolorous. Sternum cordate, dark brown, yellowish in the centre, surface uneven, clothed with long yellowish hairs. Abdomen ovate, large, projecting over base of cephalothorax, clothed with short yellowish hairs; colour, yellowish-grey, the upper surface ornamented with a large and prominent dark grey leaf-like design, extending from near anterior to posterior extremity; sides yellowish-grey, with dark markings; inferior surface light grey at sides; at centre, extending from epigyne to spinnerets, there is a long sooty-black patch, broadest near anterior extremity; on each side of this patch there is a long white band, broadest at posterior extremity, and these are bordered again with a sooty-black stripe somewhat broadest at its anterior extremity; on each side of spinnerets, and seated somewhat in front, there is a large white spot. Epigyne a long, transverse slit, with a broad, and fairly prominent dark brown lip overhanging.

One mature and one immature specimen.

Epeira hoggi, sp. nov.

(Plate v., figs. 1, 1a.)

♀. Cephalothorax, 4mm. long, $2\frac{1}{2}$ mm. broad; abdomen, 6mm. long, $3\frac{1}{2}$ mm. broad.

Cephalothorax convex, pale yellow with broad lateral longitudinal brown bars, the whole surface clothed with hoary hairs. Caput arched, moderately high, truncated in front; a longitudinal dark brown stripe commences at ocular area, where it is much the broadest and terminates at the median longitudinal cleft situated at the junction of cephalic and thoracic segments. Clypeus broad, arched, lateral radial grooves indistinct. Marginal band broad, yellow, fringed with short, hoary hairs. Eyes

of an opaline tint with black rings; the four central eyes are seated upon a slightly elevated and somewhat quadrangular surface, and form a trapezium; of this group the two comprising the front row are somewhat larger than those of the second, and are separated from each other by a space equal to about twice their individual diameter; those of the second row are separated from their front neighbours by a space equal to about one-and-a-half the diameter of an eye of the front row, and from each other by once their individual diameter; side eyes seated obliquely on small tubercles, and nearly contiguous to each other. Legs long and strong, of a somewhat yellowish-green colour with broad dark brown annulations; each limb clothed with yellowish and dark brown hairs, and armed with long, black spines; relative lengths, 1, 4, 2, 3. Palpi similar in colour and armature to legs. Falces long, glossy, strong, divergent at apex, inner margins fringed with white hairs; colour, at base, dark brown, at apex, yellowish-brown; each margin of the furrow of each falx armed with a row of three teeth; fangs dark brown at base, wine-red at points. Maxillæ broad, moderately arched, divergent, dark brown at base, yellow at apex at inner margins; fringed on outer margins with long dark hairs and on the inner with yellowish pubescence. Labium short, broad, arched, dark brown at base, yellowish at apex. Sternum shield-shaped, convex, dark brown with yellowish median streak, commencing at anterior extremity and continuing to about two-thirds its length; moderately clothed with short hairs. Abdomen ovate, projecting over base of cephalothorax, moderately clothed with rather long yellowish hairs; colour, yellowish-grey, with a large dark brown leaf-like design, somewhat lighter at the middle, and relieved laterally with whitish flecks; sides grey with dark brown markings, terminating in a large dark patch near spinnerets; inferior surface dark brown with lateral patches of yellowish-grey in front, and patches of white near spinnerets. Spinnerets long, prominent, yellow-brown. Epigyne a transverse slit, with large yellow overhanging lip.

One specimen.

I have very much pleasure in dedicating this species to my esteemed friend and correspondent, Mr. H. R. Hogg, M.A., of Cheniston, Victoria, author of the admirable and valuable paper on "The Araneidæ of the Horn Exploring Expedition."*

Epeira speciosa, sp. nov.

(Plate v., figs. 2, 2a.)

♀. Cephalothorax $1\frac{1}{2}$ mm. long, 1 mm. broad; abdomen, $2\frac{1}{2}$ mm. long, $1\frac{1}{2}$ mm. broad.

* Rep. Horn Expl. Exp., ii., Zool., pp. 309-356, pl. 24. 1896.

Cephalothorax convex, yellow-brown, with a longitudinal dark brown stripe proceeding from the front to posterior extremity. Caput high, strongly arched, truncated in front, normal grooves distinct; furnished with a few long hoary hairs. Clypeus arched, furnished with a few hoary hairs; lateral radial grooves indistinct. Marginal band narrow, fringed with hoary pubescence. Eyes of a glassy-yellowish colour; the four comprising the central group are equal in size, and form a trapezium; of these the two constituting the front row are separated from each other by a space equal to fully twice their individual diameter; the second row is separated from the first by a space equal to nearly two diameters, and from each other by rather more than one diameter; lateral pairs placed obliquely on small tubercles, and nearly contiguous. Legs long, strong, yellowish-brown, clothed with long yellowish hairs, and armed with long yellowish spines; relative lengths, 1, 2, 4, 3; the second and fourth pair co-equal, but somewhat shorter than the first. Palpi similar in colour and armature to legs. Falces dark brown, long, strong, divergent at apex. Maxillæ dark brown, arched, inclining inwards. Labium concolorous, broader than long. Sternum dark brown, shield-shaped, convex, surface sparingly clothed with hoary hairs, the sides rather thickly so. Abdomen ovate, overhanging base of cephalothorax, clothed with pale yellowish pubescence; colour: saffron, a longitudinal dark brown mark extends for a short distance from anterior extremity, at the termination of which there are three dark brown spots, two of which are somewhat lateral, and the third, which is placed a little lower down is seated in the median line; commencing about midway there is a broad, dark leaf-like design which terminates near the posterior extremity; sides of a saffron colour also; inferior surface concolorous laterally with dark brown markings; a dark brown patch, narrowest at centre, extends from epigyne to spinnerets. Epigyne a transverse curved slit with a large broad lip overhanging.

Three specimens.

FAMILY TETRAGNATHIDÆ.

Tetragnatha laqueata, L. Koch.....One ♀ specimen.
L. Koch, Die Arachniden Australiens, i., pp. 190-2, T. xvi.,
figs. 5-5f, 1871.

FAMILY EULOBORIDÆ.

Uloborus zosis, Walck.....Twelve ♀ specimens.
Uloborus zosis, Walck., Hist. Nat. des Ins. Apt., ii., p. 231,
pl. 20, fig. 2 (*Zosis caraibe*), 1841.
L. Koch, Die Arachniden Australiens, i., pp. 221-4, T. xix.,
figs. 3-3e, 1871.

Thor., Studi sui Ragni, etc., ii., Ragni di Amboina, *loc. cit.*, pp. 129-33, 1878.

Thor., Studi sui Ragni, etc., iii., Ragni dell' Austro-Malesia e del Capo York, p. 158, 1881.

FAMILY SCYTODÆ.

Dictis striatipes, L. Koch.....One ♀ specimen.

L. Koch, Die Arachniden Australiens, i., pp. 294-6, T. xxiv., figs. 5-5e, 1871.

FAMILY DRASSIDÆ.

Clubiona alveolata, L. Koch.....Three ♀ specimens.

L. Koch, Die Arachniden Australiens, i., pp. 421-3, T. xxxiii., figs. 7-7a, 1871.

FAMILY THOMISIDÆ.

Sarotes debilis, L. Koch.....One ♀ specimen.

L. Koch, Die Arachniden Australiens, i., pp. 671-3, T. lv., figs. 3-3a, 1871.

S. regius, Fabr.....Three ♀ specimens.

L. Koch, Die Arachniden Australiens, i., pp. 675-8, T. lvi., figs. 1-1a, 2-2b, 1871.

The specimens were taken in a native's hut.

FAMILY SALTICIDÆ.

Acompse suavis, L. Koch.....One immature ♀ specimen.

L. Koch, Die Arachniden Australiens, ii., pp. 1146-9, T. xcix., figs. 6-6d, 7-7d, 1883.

Genus HYLLUS, C. Koch.

Hyllus ferox, sp. nov.

(Plate v., figs. 3, 3a, 3b, 3c.)

♀. Cephalothorax, 6mm. long, 5mm. broad; abdomen, 7mm. long, 4mm. broad.

Cephalothorax somewhat shield-shaped, long, broad, high, reddish-brown. Caput reddish-brown, with purple tinge in front, and clothed with a few yellowish scale-like hairs; besides these latter it is also fringed in front and at the sides with a few rather long reddish-brown hairs; below the front row of eyes the margin is thickly clothed with yellowish pubescence. Clypeus broad, arched, reddish-brown, sparingly clothed with short yellowish pubescence; a moderately deep depression is seated midway between the two eyes comprising the third or posterior row; laterally, immediately under each eye of the second row, and seated rather low down, there is a large and prominent tubercle.

Marginal band narrow, black. Eyes of a pearl-grey lustre with black rings; each is surrounded with a thick fringe of red scale-like hairs; those comprising the front series form a curved row, the curvature directed forward; of these the two central eyes are much the largest; the two comprising the second row are exceedingly minute, and are placed midway between the lateral eyes of the front row, and those of the third series; the latter are equal in size, or nearly so, to the lateral eyes of the front row, and are separated from them by a distance of one and a half millimeters. Legs moderately long, reddish-brown; the anterior pair are the longest and much the strongest; each ambulatory limb is clothed with yellowish hairs, and armed with long, strong, black spines; relative lengths, 1, 2, 4, 3. Palpi rather long, slender, yellowish, clothed with long yellow hairs, and armed with short, strong, black spines. Falces robust, moderately long, strongly arched in front, divergent at apex, reddish-brown, with a somewhat purple tinge, thickly clothed at base with rather long yellowish hairs, and scantily so in front, and at outer margins with short yellowish pubescence; inner margins rather more freely clothed with somewhat longer hairs; the upper margin of the furrow of each falx is armed with a row of four teeth, and the lower margin with a row of two; fangs long, strong, reddish-brown. Maxillæ long, club-shaped, moderately arched; the surface sparingly clothed with rather long hoary hairs, and the inner margins at apex thickly so with long dark brown hairs. Labium concolorous, long, conical, thickly clothed with long yellowish hairs. Sternum elliptical, convex, pale-yellowish, thickly clothed with long yellowish hairs. Abdomen oblong-ovate; superior surface thickly clothed with short, closely adpressed golden scale-like hairs, and are furnished with a few long yellowish hairs; commencing at a distance of two millimetres from anterior extremity, and continuing towards spinnerets, there are two lateral sooty-black bands, the margins of which are sinuous; these bands are rounded off in front and pointed at posterior extremity; sides lightly grooved or furrowed, thickly clothed with short adpressed golden scale-like hairs; inferior surface pale yellow, thickly clothed with short yellowish pubescence. Epigyne slightly elevated in front, with two somewhat spherical lobes; deeply grooved laterally and in front. Spinnerets long, yellow-brown, thickly clothed with long yellowish hairs.

One specimen.

Speaking of this capture Mr. Hedley says:—"This example was the only one seen by any of the party; but no credit accrues to me for collecting it, for the creature obligingly collected itself. With an interest for biological research, and in a spirit of self-sacrifice which other undescribed species would do well to copy, she dropped straight into a collecting-tube. I was at the time

crouched under a mangrove tree (*Rhizophora mucronata*), at the edge of the swamp, picking specimens of an *Enteropneusta* from a puddle, so I permitted the spider, when it descended from the leaves above, to drown in the water, and transferred it to formol when I reached camp."

Hyllus audax, sp. nov.

(Plate v., figs. 4, 4a.)

♀. Cephalothorax, 4mm. long, $3\frac{1}{2}$ mm. broad; abdomen, $5\frac{1}{2}$ mm. long, 3mm. broad.

Cephalothorax somewhat shield-shaped, long, broad, high. Caput dark brown approaching bistre, glabrous above, fringed in front and at sides with a few rather long dark brown hairs, and below the front row of eyes thickly clothed with silvery scale-like hairs. Clypeus broad, arched, reddish-brown, sparingly clothed with short hoary pubescence; there is a moderately deep depression seated midway between the two eyes comprising the third posterior row; immediately under each eye of the second row, and seated moderately low down, there is a large and prominent tubercle. Marginal band narrow, black. Eyes similar to those of *H. ferox*, Rainb., except in so far as the space intervening between the third row and the lateral eyes of the front series, the distance in this species being one millimetre. Legs moderately long, reddish-brown; the first pair much the longest and strongest; each ambulatory limb is clothed with brown hairs, and armed with long, black, strong spines; relative lengths, 1, 2, 4, 3. Palpi long, somewhat lighter in colour, clothed with long yellowish hairs, and armed with short, strong, black spines. Falces robust, moderately long, strongly arched in front, divergent at apex, dark brown, clothed with a few short hoary hairs at base; inner margins rather thickly fringed with long dark brown hairs; the upper margin of the furrow of each falx is armed with a row of four teeth, and the lower margin with a row of two; fangs long, strong, reddish-brown. Maxillæ and labium as in *H. ferox*. Sternum elliptical, convex, pale yellow, moderately clothed with long, yellowish hairs. Abdomen oblong-ovate; superior surface thickly clothed with short, closely adpressed golden scale-like hairs; commencing at anterior extremity, and terminating near spinnerets, there are two lateral sooty-black bands, the margins of which are sinuous; sides lightly grooved or furrowed longitudinally, and thickly clothed with short adpressed golden scale-like hairs; inferior surface pale yellowish, thickly clothed with silvery pubescence. Epigyne slightly elevated in front, with two somewhat spherical lobes; deeply grooved laterally and in front. Spinnerets long, yellow-brown, thickly clothed with long yellowish hairs.

One specimen.

THE CRUSTACEA OF FUNAFUTI.

By THOMAS WHITELEGGE,

Zoologist, Australian Museum.

[VI.]

THE CRUSTACEA.

By THOMAS WHITELEGGE.

THE Collection consists of over three hundred specimens, representing sixty-two species, five of which are herein described as new. The various tribes are represented as follows :—

	Species.
Cyclometopa	24
Catometopa	7
Oxystomata	1
Anomura	19
Macrura	7
Stomatopoda	1
Isopoda	1
Epicaridea... ..	1
Cirripedia	1

The species regarded as new have been described as fully as possible, and include one each of *Pilumnus*, *Diogenes*, *Porcellana*, *Beteus*, and a very interesting Epicarid of the genus *Athelgue*, which was found on a Hermit Crab—*Aniculus typicus*.

I have also added such notes as would tend to aid in the identification of some of the lesser known species, and of any variations or departures from the typical forms. Among the rarer species noticed may be mentioned *Xanthodes nitidulus*, Dana; *Carpilodes margaritatus*, M. Edw.; *Actaeodes speciosa*, Dana; *Pseudoozius caystrus*, Ads. & White; *Tetralia cavimana*, Heller; *Geograpsus crinipes*, Dana; *Harpilius miersii*, De Mann; *Cirolana latistylis*, Dana, and *Lithotrya nicobarica*, Reinhardt.

The *Geograpsus crinipes* appears to be a strictly terrestrial form, breathing air direct by means of the hair-lined pores situated between the bases of the third and fourth pairs of legs, as in the genus *Ocypoda*. As far as I can ascertain, this is the first instance of a Grapsoid Crab living wholly on dry land.

Mr. C. Hedley has kindly supplied the following field notes on the Crustacea :—

"The dominant note in the life of a coral atoll, as expressed by the Funafuti fauna, struck me as the abundance and ubiquity of Crustacea. The Avifauna were but sea fowl, the indigenous Mammalia but rats, the Reptilia only a stray scink and gecko,

while insects and land mollusca, usually so profuse in tropical latitudes, were barely represented. Into the vacant places swarmed Crustacea. Not an inch of the atoll world is secure from them. The *Cænobita* wander across from shore to shore and dispute any stray edibles with the rats. Some crabs even take up their residence in the tree tops of Pandanus, while, as everybody knows, *Birgus* is as much at home on a palm bole as a squirrel on an oak. As I believe, and have endeavoured to demonstrate (pp. 22, 23, *ante*), that the coconut is foreign to the native flora, and of comparatively recent introduction from abroad, it follows that the taste for this nut has been acquired in historical times by *Birgus*, whose original food was probably Pandanus fruit.

"Human habitations are not even secure from crabs. Often while quietly reading or writing, especially at night, have I seen crabs, for instance *Ocypoda ceratophthalma*, steal warily across the floor towards some attractive food. Deterred for the moment by a missile or an exclamation, they would recommence like any impertinent mouse their pertinacious efforts when attention lulled. One impudent intruder established himself in a burrow under my very bunk.

"Active as they are during the day, it is at night that the land crabs hold high carnival. A traveller has thus described his experience of his first night on an atoll* :—'It was fortunate that we had provided ourselves with lights, or we might have imagined our habitation to be occupied by every noxious reptile. As far as the fading daylight had shown us, the Island appeared covered with rough pebbles of coral. Imagine our surprise on lying down to sleep, to find that all these imaginary pebbles had become endowed with animation. A dull crackling, or rather rustling, noise seemed to pervade the air, earth and sea, and so disagreeably near to us, that I started up to ascertain the cause. Judge of my astonishment, when I perceived the numerous rough looking pebbles all alive, moving about briskly upon the floor of our hut, and crawling over our mats in all directions. A little nearer inspection discovered them to be shells of a species of perrywinkle of all sizes, each being occupied by a kind of hermit crab, projecting his rough and ugly looking claws from the orifice of the shell. I went outside, and found the entire surface of the Island in motion. The moon enabled us to see that not only on the ground, but even on the trunks of the trees, on the roofs of the huts, and every place to which their claws could gain access, there were these creatures to be found.'

"On the beaches the Crustacea were everywhere abundant, particular species possessing each their special zone. About high tide mark on the windward shore promenaded *Grapsus maculatus*,

* Webster—Last Cruise of the "Wanderer," n.d., p. 55.

a crowd of which scattered before the footsteps of a visitor, and sought refuge under loose coral blocks or in deep pools. Rolling over a slab of dead coral rock anywhere between tide marks exposed the haunt of a little community of *Petrolisthes dentata* and *Leiolophus planissimus*. Intercepted in their efforts to escape, these would flatten themselves down to the surface of the stone so closely that the collector's fingers with difficulty grasped them. The deeper rock-pools at the border of the reef-flat, the chief home of *Salarius*, were usually tenanted by a few *Calcinus elegans*, whose brilliant red, blue, and white claws distinguished it as the dandy of the company. This species is never found out of the range of rough waves. The extreme windward portion of the reef left dry at low tide was but rarely attainable; *Aniculus*, whose bristly claws usually protruded from a stolen *Turbo* shell, was a distinctive feature of this zone. In the honey-combed pits of the nullipore mounds that breasted the surf, cowered *Daira perlata*. The close resemblance of colour and contour to the surrounding rock, rendered this crab difficult to detect, and when seen the creature's powers of adherence and the sweep of the Pacific rollers rendered it as difficult to seize.

"The mangrove swamp was very barren of Crustacea compared to the usual population of such places. One quite missed the droll little *Gelasinus*, waving his big claw in defiance. After gathering coconuts, the natives usually husk them on the spot and throw the discarded husks in a pile to decay. These stacks of rotting husks are prolific collecting grounds for Invertebrata in general, and the favourite shelter in day time for *Birgus* and *Cardisoma*, the latter of which also burrowed in soft muddy places."

BRACHYURA.

Tribe CYCLOMETOPA.

ATERGATIS FLORIDUS, *Rumph.*

Atergatis floridus (Rumph.), Dana, Crust. U.S. Explor. Exped., i., p. 159, pl. vii., fig. 4.

Fourteen specimens of this very common species were obtained on the outer reef at low tide line.

ACTÆA RUGATA, *Adams & White.*

Actæa rugata, Adams & White, Voy. "Samarang," Crust., 1848, p. 43, pl. viii., fig. 5.

One half-grown example, the colour being well preserved. The upper surface of the carapace presents three reddish and four white longitudinal lines, disposed as follows: a median red line extending from the front to the first post abdominal segment,

where it bifurcates and is continued on the second. The two lateral red bands commence at the external orbital angles, and by slight curves extend to the commencement of the postero-lateral borders; the external white lines are confined to the antero-lateral lobes; the inner pair of white lines commences at the orbital borders and is continued to the posterior margin of the carapace.

The cardiac region appears to the unaided eye as if it had a median groove, but on closer inspection with a lens it is seen that this appearance is due to the deeper shade of red rather than to a depression.

The hairs on the carapace are yellowish, the longer ones forming fringes around the bases of the lobules, and the shorter ones at the bases of the granules.

Length of carapace 8mm.

Breadth of carapace.....10mm.

XANTHODES LAMARCKII, M. Edw.

Xanthodes lamarckii, M. Edw. Hist. Nat. Crust., i., p. 391; Nouv. Arch. Mus., ix., p. 200, pl. vii., fig. 3; *X. granosomanus*, Dana, Crust. U.S. Explor. Exped., i., p. 175, pl. viii., fig. 10a.

There are five examples of this species—three males and two females: the post abdomen in the latter is fringed with long hairs.

XANTHODES NITIDULUS, Dana.

Xanthodes nitidulus, Dana, Crust. U.S. Explor. Exped., i., p. 177, pl. viii., fig. 11, a, b, c.

A solitary female of this rare and beautiful species was collected.

It presents several important characters not mentioned in the original description by Dana. The carapace is smooth, shining, and minutely punctate; when viewed with a lens it is seen to be covered with a uniform but microscopic granulation. On the chelipedes and ambulatory legs the granules tend to become seriate and form reticulating lines with smooth spaces between.

On the sub-hepatic and pterygostomial regions the granules are larger and visible to the unaided eye, more especially along the line defining the regions, and extending from below the basal joint of the external antennæ to below the second antero-lateral spine.

The chelipedes are equal; the ischium is hairy and granulose, on its anterior edge, at its distal extremity, is a low tooth bounded by a transverse groove.

The external surface of the merus is smooth and convex; the anterior granular; the internal concave, adapted to the shape of

the carapace, and its margins fringed with hairs; a compressed tooth exists near the distal end of the upper margin, which is separated by a groove from a similar but smaller tooth at the extremity. The carpus has two blunt teeth on its inner distal angle, the lower and smaller one granular at the base. The impression mentioned by Dana on its upper surface is more like Y reversed than V.

The fingers are acute, crossed at the tips and in contact throughout when closed; they are blackish-brown with white points.

The ambulatory legs are fringed above with long yellow hairs. The upper edges of the merus joints are acute to within a short distance of the distal extremity. The hairs on the carpal, propodal and tarsal joints are shorter than those on the meral.

The carapace and limbs are marbled with flesh-colour, red, and orange.

Length of carapace, 28mm.; breadth (posterior pair of lateral spines included), 44mm.

Obtained on the edge of the outer reef amongst the Nullipores.

ZOZYMUS ÆNEUS, Dana.

Zozymus æneus, Dana, Crust. U.S. Explor. Exped., i., p. 192, pl. x., fig. 3.

One male of this very common species, obtained amongst the nullipores on the outer reef.

DAIRA PERLATA, Herbst.

Daira perlata (Herbst.), Dana, Crust. U.S. Explor. Exped., i., p. 204, pl. x., fig. 14.

One adult female, found in the honeycomb crevices of the nullipore mounds on the outer reef.

ETISUS LÆVIMANUS, Randall.

Etisus lævimanus (Randall), Dana, Crust. U.S. Explor. Exped., i., p. 185, pl. x., fig. 1a.

One adult male.

ETISODES CÆLATUS, Dana.

Etisodes cælatus, Dana, Crust. U.S. Explor. Exped., i., p. 188, pl. ix., fig. 4.

Two immature males.

CARPILODES MARGARITATUS, M. Edw.

Carpilodes margaritatus, M. Edw., Nouv. Arch. Mus., ix., p. 182, pl. v., fig. 2.

One half-grown male of this pretty little species is in the collection.

The specimen agrees well with the description and figure, excepting the chelipedes; the slight difference may be sexual (the sex of the type is not stated).

The black colour of the immobile finger extends a short distance on the palm; there are also indications of two faint longitudinal ridges, one in a line with the upper border of the immobile finger and the other opposite the space between the fingers.

This species is also found in New Caledonia.

PILUMNUS VESTITUS, *Haswell*.

Pilumnus vestitus, Haswell, Cat. Austr. Mus., v., Crust., p. 68, 1882; Miers, in Chall. Rep.—Zool., xvii., p. 159, pl. xiv., fig. 3.

There is one small male in the collection.

As Dr. De Mann in his Crustacea of the Mergui Archipelago* remarks that a more exact knowledge of this species is desirable, I venture to give a few of the characters which may aid in its future identification, derived from the examination of specimens obtained in Port Jackson. The frontal, gastric, cardiac, and postero-lateral regions of the carapace are smooth, appearing punctate only when the hairs are removed, each hair arising from a small depression, more especially on the posterior portion of the pterygostomial region which is minutely and closely punctate, as is also the posterior lateral sides and the hinder margin of the carapace.

The slightly elevated line marking the posterior border of the carapace is granulose, the line is continued on each side as far as the insertion of the chelipedes but the granules are much smaller and closer.

The lobes of the front and the external halves of the upper orbital borders are more or less granulose, the lower orbital border with from eight to twelve subspiniiform granules. The lower internal and the external angles are distinctly spinose. A sub-hepatic spine is also present.

The first and second antero-lateral teeth are a little compressed at the base; they are punctate and granular on their external aspect; the third tooth is without granules; each tooth ends in a conical horny point.

On the upper surface of the carapace, near the antero-lateral teeth are situated a few horny spines and numerous subspiniiform granules which extend towards the gastric and cardiac regions.

In some large male examples, the first and second teeth have each an accessory spine behind.

The chelipedes are unequal, the right being the largest.

* Journ. Linn. Soc.—Zool., xx., 1888, p. 65.

The merus is armed on its upper distal border with two spines separated by a groove; there are also two spiniform granules posterior to these, about the middle.

The carpus has five more or less distinct rows of spines on its outer and upper surface; four of the rows form a reversed V within a V, the larger V interrupted at its base near the articulation with the hand. The fifth row occupies the upper margin and consists of from four to six spines.

On the external surface of the palm there are three or four rows of spines, sometimes incomplete.

The mobile finger is sulcate near its base, and has three rows of subspiniform granules; in the right chelipede of the male the granules are scattered.

The lower border and internal surface of the large hand are smooth; the left chelipede in both male and female has the lower border granulose, and there is a longitudinal line of from four to six granules on the inner median surface of the palm.

The upper edges of the merus of the first three pairs of ambulatory legs are armed with three spines, two of which are curved and situated about the middle; the third is straight, and projects at the distal extremity. The lower margins have a few spiniform granules. The carpal joints of the first and second pairs of legs are armed above with five spines, four of which are equal in size and apart; they are confined to the proximal two-thirds of the upper edge; the fifth spine is at the distal extremity.

External to the spines on the crest of the carpus on the posterior upper surface are situated four similar spines not extending beyond the proximal half of the joint. These spines are bounded below by a shallow longitudinal groove which is quite smooth and shining. Both merus and carpus of the fourth pair of legs are without spines, excepting those at the distal extremities.

Length of carapace of male	17mm.
Breadth ,, male	23mm.
Length ,, female	14mm.
Breadth ,, female	19mm.

PILUMNUS PRUNOSUS, sp. nov.

(Plate vi., fig. 1, *a*, *b*.)

The carapace is transversely and longitudinally convex; both it and the legs are clothed with a short down and stiff yellowish brown hairs. The antero-lateral margins are longer than the postero-lateral. The surface of the carapace is smooth; if the hairs are removed the surface appears punctate, the pits being the depressions from which the hairs originate; regions scarcely perceptible.

The front is declivous, thin, smooth, and consisting of two rounded lobes separated by a median notch, from which a shallow groove extends to the epigastric region. Laterally the lobes are separated from the internal orbital angles by a very slight sinus and a pair of granules, the outer of which is the largest.

Front, upper and lower orbital margins defined by a narrow continuous line, several shades lighter in colour than the adjacent parts; a similar line exists on the margins of the episternum and of the post-abdomen.

The upper orbital borders are smooth, the internal angle rounded; the external marked by a wide sinus and a small spine. The lower orbital border distantly granulose, four of the inner granules tending to become spiniform, the second one much larger than the others; a narrow hiatus exists at the infero-external angle.

The suborbital surface, apart from the margin, is smooth externally, a narrow band of granules extend from the base of the inter-orbital to the external and first antero-lateral spines.

The sub-hepatic spine is absent, its place is occupied by three or four small rounded granules.

First and second antero-lateral spines compressed, the third round and broad at the base. Each spine terminates in an acute point. In the female the external orbital spine has a small accessory spine at its base.

The outer antennæ are fairly long and reach to the first antero-lateral spine; the basal joint is almost in contact with the descending process of the front; it narrows distally and is twice as long as broad; penultimate shorter and stouter than the ultimate; the latter and the distal half of the former can be seen from above, projecting beyond the external angle of the front.

The chelipedes are unequal, the right the larger. Merus and carpus equal in length, the former trigonous and smooth excepting the margins. The inferior angle has a row of about nine granules, the four proximal forming a curved line towards the antero-internal angle. The short anterior angle has two granules, the distal one subspiniform. The superior margin is armed with two or three subspiniform granules and two acute spines distally, which are separated by a well-defined groove. The carpus is clothed with long hairs and subspiniform but seldom acute tubercles; there is an impressed line near its articulation with the hand, and a spine on its inner margin.

The subspiniform granules on the hand are seriate and consist of seven longitudinal rows; the lower border is granulose near the base of the finger; proximally it is smooth in the male, but granular and hairy throughout in the female. On the outer surface of the palm are four rows, the lowest in line with the third

denticle of the finger, the next in line with the basal denticle, the third opposite the space between the fingers, and the fourth in a line with base of the mobile finger. Between the first and second rows, and opposite the middle tooth of the immobile finger, is situated a short line of three granules; one of these granules is on the finger. On the upper surface are situated two rows, one extending from a notch above the articulation of the middle finger to the articulatory boss where the hand joins the carpus, the other opposite to the superior base of the mobile finger. The crest has four or five spiniform granules, which are similar to those on the rest of the palm. The inner surface of the palm is convex, with a few small granules near the centre and several long hairs. Hand, with the lower border of palm, twice as long as the upper (immobile finger excluded) and as broad distally as the carpus is long. The immobile fingers are bent downwards, faintly sulcate, deeper coloured in their distal halves only; armed with six denticles, the three proximal ones a little larger than the distal. The mobile fingers are faintly denticulate on their edges; they are granulose above at the base, but elsewhere the surface is smooth.

The merus joints of the ambulatory legs are compressed and sharp edged above, rounded below and smooth, excepting the last pair which are finely granulose below, as are also the ischium joints distally. There is a well marked transverse groove near their distal end.

The carpus joints are armed with two rows of spinules, the superior one consisting of six or seven spines, somewhat equidistant but unequal in size. The second row is situated on the median posterior surface, and consists of four or five spiniform granules. On the propodal joints, in a line with the latter, are also five similar spinules. At the distal ends of the propodal joints of the first pair there are three spines superiorly and two laterally; in the succeeding pairs they are indicated by granules. Tarsi shorter than the preceding joints, fringed above and below with long hairs and terminating in a slightly curved horny point.

The post abdomen is smooth, shining, and distantly punctate, its edges fringed with long hairs in the female, and with very short ones in the male. The terminal segment in the latter does not extend beyond the articular nodules of the first joints of the chelipedes; if a line is drawn from one nodule to the other across the sternum, it would pass clear of the tip of the seventh joint. This character appears to be important, and may be of use in separating the species of this most difficult genus into groups.

I have examined most of the males in the Museum Collection, the results are as follows:—in twelve males of *Pilumnus rufopunctatus* and in the type of *P. monilifera* the seventh segment

just reaches the line above-mentioned, in one male each of *P. glaberrimus* and of *P. cursor* and in twelve males of *P. fissifrons*, the terminal joint extends a little beyond the line. Whilst in thirty-one males of *P. vestitus*, five of *P. teræ-regina*, and five of *P. vespertilio*, the seventh joint extends over the line from $1\frac{1}{2}$ to 2mm. The specimens examined include large and small of all ages, the character appears to be a constant one as far as the material in hand shows, whether it is so in other species of the genus remains to be seen, by the examination of a larger series of specimens.

The carapace is plum coloured with the cardiac region and posterior margin reddish-brown, the chelipedes are ornamented with orange-coloured spiniform granules. The ambulatory legs and under surface of the body similar to but grayer than the carapace. The chelipedes are a shade lighter, the mobile fingers dark reddish-brown with the base pale and of the same tint as the palm, the immobile fingers darker coloured in their distal half only.

Length of carapace of male.....	10mm.
Breadth " " (spines included)	15mm.
Length of carapace of female	$8\frac{1}{2}$ mm.
Breadth " " 	12mm.

Seven males and one female.

ACTÆODES SPECIOSA, Dana.

Actæodes speciosa, Dana, Crust. U.S. Explor. Exped., i., pl. xi., fig. 4a.

Three small males somewhat doubtfully referred to this species. The blackish-brown colouration of the fingers extends on the lower border and the exterior surface of the palm for a considerable distance. The body and ambulatory legs are yellowish-white.

PHYMODIUS MONTICULOSUS, Dana.

Phymodius monticulosus, Dana, Crust. U.S. Explor. Exped., i., p. 206, pl. xi., fig. 9.

There are four males and two females in the collection.

PSEUDOZIUS CAYSTRUS, Adams & White.

Pseudozius caystrus, Adams & White, Voy. "Samarang," Crust., p. 42, pl. ix., fig. 2.

Fourteen specimens.

The "*Ozius* sp." in Haswell's Cat. Austr. Mus., v., Crust., p. 68, No. 108, is identical with this species. There are specimens in the Museum from Tasmania, Solomon Islands, Holborn Island, Woodlark Island, and Port Denison.

LEPTODIUS EXARATUS, *M. Edw.*

Leptodius exaratus, M. Edw., Hist. Nat. Crust., i., p. 402;
Dana, Crust. U.S. Explor. Exped., i., p. 207.

Five specimens of this widely distributed species. Found under stones on the outer reef at low tide.

LEPTODIUS SANGUINEUS, *M. Edw.*

Leptodius sanguineus, M. Edw., Hist. Nat. Crust., i., p. 404;
Dana, Crust. U.S. Explor. Exped., i., p. 207, pl. xi., fig. 11.

Three examples—two males and one female.

RUPPELLIA ANNULIPES, *M. Edw.*

Ruppellia annulipes (M. Edw.), Dana, Crust. U.S. Explor. Exped.,
i., p. 346, pl. xiv., fig. 4.

One small male which agrees with Dana's figure as to colouration and structural characters generally.

ERIPHIA SCABRICULA, *Dana.*

Eriphia scabricula, Dana, Crust. U.S. Explor. Exped., i., p. 247,
pl. xiv., fig. 5a.

Five specimens—three males and two females.

The carapace is mottled with brown spots; the legs are transversely banded with the same colour; when viewed with a lens the brown pigment is seen to form reticulating lines.

ERIPHIA LEVIMANA, *Latr.*

Eriphia levimana (Latr.), Dana, Crust. U.S. Explor. Exped., i.,
p. 249, pl. xiv., fig. 7, a, b, c.

Five adult specimens—three males and two females with ova. Found on the lagoon shore between tide-marks on sandy flats.

TRAPEZIA CYMODOCE, *Herbst.*

Trapezia cymodoce (Herbst.), Dana, Crust. U.S. Explor. Exped.,
i., p. 257, pl. xv., fig. 5.

Eight specimens, mostly immature. Obtained from pools at low water on the lagoon shore.

TRAPEZIA FERRUGINEA, *Latr.*

Trapezia ferruginea (Latr.), Dana, Crust. U.S. Explor. Exped.,
i., p. 260, pl. xvi., fig. 1.

Four specimens obtained from a depth of forty fathoms.

TETRALIA CAVIMANA, Heller.

Tetralia cavimana, Heller., Sitzb. K. Akad. Wiss. Wien., xliii., p. 353, taf. iii., figs. 24, 25.

One adult female.

The characteristic depression, near the proximal end of the palm, is well defined in the larger hand (the right), and clothed with hairs, the more elongate of which appear to be confined to the margin of the depression; there are also a few similar hairs present on the distal end of the carpus.

THALAMITA INTEGRA, Dana.

Thalamita integra, Dana, Crust. U.S. Explor. Exped., i., p. 281, pl. xvii., fig. 6.

Five specimens—four males and one female with ova.

THALAMITA ADMETE, Herbst.

Thalamita admete (Herbst.), Dana, Crust. U.S. Explor. Exped., i., p. 281, pl. xvii., fig. 5.

Seven males and seven females, two bearing ova.

Tribe CATOMETOPA.

CARDISOMA HIRTIPTES, Dana.

Cardisoma hirtipes, Dana, Crust. U.S. Explor. Exped., i., p. 376, pl. xxiv., fig. 2.

Thirteen specimens. Native name "Keibea."

OCYPODA CERATOPHTHALMA, Pallas.

Ocypoda ceratophthalma (Pallas), Miers, Ann. & Mag. Nat. Hist. (5), x., p. 379, pl. xvii., fig. 1.

Six specimens—four adult males and two immature females.

GELASIMUS TETRAGONON, Herbst.

Gelasimus tetragonon (Herbst.), M. Edw., Hist. Nat. Crust., ii., p. 52; Ann. Sci. Nat. (3), xviii., p. 147, pl. iii., fig. 9.

Two males and one female.

The granulation of the merus joints of the ambulatory legs differs considerably in the two sexes. In the male the lower edges of the merus joints are finely granular, the space between and also the posterior lateral surface is punctate and very distantly granulose. In the female the inferior edges of the last two pairs of legs are almost denticulate, the posterior surface and the proximal half of the lower are very closely granulate, on the upper posterior surface the granules are transversely seriate.

METOPOGRAPSUS MESSOR, *Forsk.*

Metopograpsus messor (Forsk.), M. Edw., Ann. Sci. Nat. (3), xix., p. 165.

Three small males.

GRAPSUS MACULATUS, *Catesby.*

Grapsus maculatus (Catesby), M. Edw., Ann. Sci. Nat. (3), xx., p. 167, pl. vi., fig. 1.

Four adult females.

One of the specimens has both the distal extremities of the merus joints of the last pair of legs denticulate. Very common amongst the rocks about high-tide mark on the outer reef, but never observed in the calmer waters of the lagoon.

GEOGRAPSUS CRINIPES, *Dana.*

Geograpsus crinipes, Dana, Crust. U.S. Explor. Exped., i., p. 341, pl. xxi., fig. 6.

Two adult females.

The bases of the second and third ambulatory legs are furnished with fringes of hairs, as in *Ocypoda*, but they are longer and much finer than those usually found in members of that genus. Mr. C. Hedley informs me that the specimens occurred in association with *Cenobita* and *Cardisoma*, at a distance from the sea, among broken coral blocks shaded by palms and other vegetation. This appears to be a highly interesting instance of adaptation to terrestrial conditions, not only as to breathing by means of the hair-clothed apertures between the bases of the second and third pairs of legs, but also in colour which is a dirty yellowish-white, and seems well suited to harmonize with the tint of the coral fragments amongst which it lives. The left chelipede is slightly the larger, the fingers when closed have a large gap at the base, the fingers of the smaller hand almost meet throughout when closed.

LEIOLOPHUS PLANISSIMUS, *Herbst.*

Leiolophus planissimus (Herbst.), Miers, Ann. & Mag. Nat. Hist. (5), i., p. 153.

Two specimens—one male and one female.

This species occurred under stones in company with *Petrolisthes dentatus*, at low water mark.

Tribe OXYSTOMATA.

CALAPPA HEPATICA, *Linn.*

Calappa hepatica, Linn., Syst. Nat. ed. xii., p. 1048, 1766.

One adult female.

*Tribe ANOMURA.*CRYPTODROMIA JAPONICA, *Henderson.*

Cryptodromia japonica, Henderson, Chall. Rep. Zool., xxvii., p. 6, pl. i., fig. 2.

Two specimens—one male and one female.

The examples agree fairly well with the description and figure given by Henderson, the hairs on the carapace are more abundant, and the ill defined tubercle mentioned as occurring at the posterior end of the medium groove leading to between the lateral rostral teeth is absent. The hairs on the body and limbs are plumose in their distal halves only, whilst the hairs on *C. lateralis* are plumose throughout, but the branchlets are much shorter than those on the hairs of *C. japonica*.

REMIPES TESTUDINARIUS, *Latr.*

Remipes testudinarius (Latr.), M. Edw., Hist. Nat. Crust., ii., p. 406, pl. xxi., figs. 14-15.

Five specimens—two males and three females with ova. Found on the sandy shore of the lagoon.

BIRGUS LATRO, *Linn.*

Birgus latro (Linn.), Dana, Crust. U.S. Explor. Exped., i., p. 474, pl. xxx., fig. 5.

Four half grown examples and one young specimen 25mm. long, which does not differ materially from the adult, except in size and colour; the carapace and abdominal plates are pale yellow, the ambulatory legs are a warm brown, the carpus and hand are yellowish-white with the spines brown. The colour generally is very similar to that of some of the young of *Cenobita rugosa*.

CENOBITA OLIVIERI, *Owen.*

Cenobita olivieri, Owen, Voy. "Blossom," Zool. Crust., p. 84.

Two specimens in the shells of *Turbo setosus*, Gmelin. Native name, "Ounga Koula."

CENOBITA CLYPEATA, *M. Edw.*

Cenobita clypeata, M. Edw., Hist. Nat. Crust., ii., p. 239.

Two specimens inhabiting the same kind of shell as the preceding species. Native name, "Ounga Ouri."

CENOBITA RUGOSA, *M. Edw.*

Cenobita rugosa, M. Edw., Hist. Nat. Crust., ii., p. 241; Dana, Crust. U.S. Explor. Exped., i., p. 471, pl. xxx., fig. 1.

Seven examples, inhabiting the following species of shells:—*Planaxis sulcatus*, Lam., *Vertagus lineatus*, Brug., *Triton pilearis*,

Linn., *T. gemmatus*, Reeve, *Ranella granifera*, Lam., and *Natica mamilla*, Linn. Obtained about high water mark on the sandy beaches; very abundant.

DIOGENES PALLESCENS, sp. nov.

(Plate vi., fig. 2, a, b, c.)

The carapace is transversely convex anteriorly, the median anterior region is smooth and is bounded on each side by several low spinulose elevations.

The antero-lateral margin is armed with eight spinules, the first one situated a very short distance from the external lobe of the front; immediately posterior to this spine is situated an accessory spine not quite in the same line; the second one is over the base of the antenna, the remaining six are situated on the lateral margin. The carapace is slightly tomentose behind the cervical groove.

The front is three-lobed, the median lobe rounded, the lateral lobes angular but not acute.

The ophthalmic scales triangular, each with three small spinules and a few setæ at their distal extremities. The rostriform process is entire, acicular, and projecting but a very short distance beyond the eye scales.

The ocular peduncles are equal in length to the peduncles of the internal antennæ. The peduncles of the external antennæ are about two-thirds the length of the eye stalks. The antennal acicle is short, scarcely exceeding the distal extremity of the penultimate joint, it is armed with three spines distally and one at its base. The second exposed joints of the external antennæ are armed with a spine at their extero-distal angles.

The left chelipede has the meral and carpal joints sub-equal in length, the former trigonus, with the angles spinulose, the latter armed on its superior margin with five curved spines, its upper and external surface with a few spiniform granules, the distal extremity is also similarly but more distinctly spinulose.

The lower border of the hand—finger included—is as long as the merus and carpus combined, the breadth of the hand at its distal end exceeds half the length of the lower border and finger.

The proximal external surface of the palm is convex and angular, with three or four spines in a line on the angle and two or three at a short distance above. The lower border of the palm and of the immobile finger is closely granulate, the crest of the hand is armed with from seven to nine small curved spines, exterior to which are a few granules, whilst the distal portion of the palm opposite the base of the mobile finger is smooth and punctate.

The inner surface of the palm is smooth, punctate, and presents a series of transverse, loop-like reticulations, the reticulæ are more or less visible on the inner surfaces of the three preceding joints.

The upper surface of the mobile finger is closely studded with small bead-like granules, the inner and outer surfaces are punctate, the lower edge has three denticles near the base.

The spinulation of the right chelipede is similar to that of the left, except that the spines are larger, the angular convexity on the proximal part of the palm is also present.

The ischium joint of first ambulatory leg of the left side is short, and not more than half the length of the same joint of the second leg. The merus of the first leg is compressed and somewhat acutely edged above and below, the lower edge is armed with six curved spines, situated close together about midway between the distal and proximal extremities. The merus of the second leg is shorter and less compressed than the merus of the first leg, moreover it is not spinose on its lower border.

The carpal joints of the first and second legs are about equal in length, they are each armed above with two spines one distal and the other proximal. The propodal joints are slightly curved, that of the first leg a little shorter than that of the second.

The tarsus is almost as long in the first, quite as long in the second, as carpus and propodus combined, it is slightly curved, sparsely fringed with long hairs, and terminates in a minute horny point.

The carapace and ambulatory legs are white, the larger chelipede has a slight reddish tint which is more intense on the merus and carpus than on the hand.

The legs are clothed with long yellowish hairs, which are often in tufts, especially on the fingers of the chelæ.

The hairs on the carapace, last two pairs of legs, and the proximal halves of the first three pairs are plumose, whilst those on the distal halves of the latter are simple and unbranched.

Total length of largest specimen.....	25mm.
Length of carapace	6mm.
Length of first ambulatory leg (left side).....	12mm.
Length of left chelipede	9mm.
Length of right chelipede.....	5½mm.

Seven specimens in the shells of *Vertagus lineatus*.

PAGURUS FABIMANUS, Dana.

Pagurus fabimanus, Dana, Crust. U.S. Explor. Exped., i., p. 454, pl. xxviii., fig. 7, a, b, c, d, e.

One specimen in the shell of *Strombus urceus*, Linn.

PAGURUS GUTTATUS, *Olivier.*

Pagurus guttatus (Olivier), Dana, Crust. U.S. Explor. Exped., i., p. 451, pl. xxxviii., fig. 3, a, b.

Four specimens of this fairly common species inhabiting the shells of *Pterocerus chiragra*, Linn., and *Strombus urceus*, Linn.

CLIBANARIUS VIRESCENS, *Dana.*

Clibanarius virescens, Dana, Crust. U.S. Explor. Exped., i., p. 466, pl. xxix., fig. 6, a, b.

One specimen in the shell of *Triton gemmatus*, Reeve.

CLIBANARIUS CRUENTATUS, *M. Edw.*

Clibanarius cruentatus, M. Edw., Ann. Sci. Nat., (3), x., 1848, p. 62; Filhol, Mission de l' Ile Campbell, 1885, p. 424, pl. xlii., fig. 4.

Two specimens in the shells of *Purpura armigera*, Chemn.

The so-called yellowish-white spots characteristic of this species are blister-like in appearance, being everywhere more or less raised above the rest of the surface. On the carapace and ambulatory legs they appear to be chitinous, and are easily perforated with a needle point, whilst the dark red parts adjacent require considerable pressure before the needle can be forced through. On exposed situations subject to friction, such as the joints of the legs, they become worn down level with the rest of the surface, they then present an abraded aspect, being closely punctate and devoid of the glossy surface common to the yellowish-white blisters and the dark red calcareous portions of the body and legs.

CALCINUS ELEGANS, *M. Edw.*

Calcinus elegans, M. Edw., Ann. Sci. Nat. (2), vi., p. 278, pl. xiii., fig. 2.

Eight examples inhabiting the following species of shells:—*Turbo setosus*, Gmelin, *Ricinula horrida*, Lam., *Mitra literata*, Lam., *Harpa minor*, Lam., and *Conus sponsalis*, Chemn. Abundant in pools on the outer reef.

CALCINUS GAIMARDI, *M. Edw.*

Calcinus gaimardi, M. Edw., Ann. des Sci. Nat., 3rd Ser., x., p. 63, 1848; Dana, Crust. U.S. Explor. Exped., i., p. 457, pl. xxviii., fig. 9.

One specimen in the shell of *Harpa minor*, Lam.

CALCINUS LATENS, *Randall.*

Calcinus latens (Randall), Dana, Crust. U.S. Explor. Exped., i., p. 459, pl. xxviii., fig. 11.

Twelve examples in the shells of *Vertagus lineatus*, Brug., and *Strombus urceus*, Linn.

CALCINUS TIBICEN, *Herbst.*

Calcinus tibicen (Herbst.), Dana, Crust. U.S. Explor. Exped., i., p. 457; Cuvier, Reg. Anim., 1849, pl. xlv., fig. 3.

Four specimens in the shells of *Vertagus cedo-nulli*, Sowb., *Triton pilearius*, Linn.; *Peristerna nassatula*, Lam., and *Cylindra dactylus*, Linn.

ANICULUS TYPICUS, *Fabr.*

Aniculus typicus (Fabr.), Dana, Crust. U.S. Explor. Exped., i., p. 461, pl. xxix., fig. 1.

Four specimens in the shells of *Turbo setosus*, Gmel.

PETROLISTHES DENTATUS, *M. Edw.*

Petrolisthes dentatus, M. Edw., Hist. Nat. Crust., ii., p. 251, 1837; De Mann, Arch. f. Nat., p. 409, pl. xii., fig. 7, 1887.

Sixteen specimens. Obtained under stones at low tide on the outer reef.

PETROLISTHES HASWELLI, *Miers.*

Petrolisthes haswelli, Miers, "Alert" Report, p. 69, pl. xxix., fig. a.

Four specimens.

PETROLISTHES SPECIOSA, *Dana.*

Petrolisthes speciosa, Dana, Crust. U.S. Explor. Exped., i., p. 417, pl. 26, fig. 8.

Six specimens.

PORCELLANA SOLLASI, sp. nov.

(Plate vii., fig. 3, a.)

The carapace is as broad as long, shining, and transversely striate, the striae are prominent anteriorly and gradually diminish towards the extremities of the postero-lateral borders, the cardiac region is smooth. Front straight when viewed from above, when seen from the frontal aspect it is depressed at the sides and in the centre, where there exists a small notch.

The upper orbital border is smooth, rounded at the inner, and with an acute spine at the outer angle. Antero-lateral margin with five oblique striae, the first short, compressed and toothlike, fourth and fifth much longer and extending towards the gastric region. The antipenultimate joints of the antennae are half as long as the penultimate, and about as long as the ultimate, the former with two small spines on its inner margin, and the latter with two spines at its distal extremity. The flagellum is naked and is as long as the larger chelipede.

The external maxillipes have the ischium and merus joints obliquely striate, the latter with a prominent internal lobe near its proximal end, the former is subquadrate and slightly convex on its inner edge.

The chelipedes in the male are unequal, the left slightly the larger. The merus has a transverse ridge rather nearer to the distal end than the proximal, on the distal edge there are three or four flattened granules. The antero-internal extremity with a compressed denticulate lobe.

The carpus is armed on its inner border with four compressed compound spines, the proximal large, the other three forming a diminishing series. Each tooth or spine branching and bearing several accessory spinules.

The superior and external surfaces are ornamented with peculiar hooked spines, which are broad, flattened, and minutely denticulate at their apices, very few are single pointed, they are apically curved, and their tips are directed towards the distal end. The under surface is smooth, the infero-internal angle has a few small compressed granules near its base. The hooked spines are at least their own diameter apart and irregularly disposed.

The lower border of the hand is straight, the upper forms almost a right angle with the mobile finger. The spines on the lower and external surfaces of the palm are similar to but smaller than those on the carpus, the upper surface has a few flat granules and the crest is smooth.

The mobile finger has two rows of sub-imbricated spines, which when viewed in profile with a lens gives it a serrate appearance.

The two lower rows of spines of the palm are continued to the extremity of the immobile finger. The internal surface of the palm is convex and obliquely striate, especially on the lower portion, striæ are also present on inner surface of the immobile finger, the mobile finger has a pair of denticles near its base, and a small hooked spine at its extremity, which is opposed to a similar spine at the tip of the immobile finger.

The merus joints of the ambulatory legs are transversely striate on their posterior surfaces, the upper edge of the merus has from four to six minute spinules, the distal one large.

The carpus is armed above with eight spines in two rows, of a similar kind to those on the carpus of the chelipedes, *i.e.*, flattened, curved, and minutely denticulate at the summit, the distal being long and considerably overlapping the base of the propodus. The length of inferior margin of the carpus scarcely exceeds the transverse diameter of the merus.

The posterior surface of the propodus is crossed by four or five oblique striæ, the upper edge is armed like the preceding joint

but the distal spines are smaller. The dactylus is robust, about half the length of the propodus, and ending distally in a curved horny point, the lower edge having three or four horny spinules.

The carapace and chelipedes are white, glossy and shining. The ambulatory legs have the carpus and propodus coloured red

One male and one female with ova.

Length of carapace of female.....	2½mm.
Breadth „ female.....	2½mm.
Length „ male	3 mm.
Breadth „ male	3 mm.
Total length of larger chelipede	8½mm.

Named in honour of Prof. W. J. Sollas, LL.D., F.R.S.

Tribe MACRURA.

IBACUS ANTARCTICUS, *Rumph.*

Ibacus antarcticus (Rumph.), M. Edw., Hist. Nat. Crust., ii., p. 287.

One adult female purchased from the natives, who called it "Tappa Tappa."

PALINURUS GUTTATUS, *Latr.*

Palinurus guttatus (Latr.), M. Edw., Hist. Nat. Crust., ii., p. 297, pl. xxiii., fig. 1.

One adult male. Native name, "Oula."

This species lives in burrows on the sandy portions of the lagoon, and is much used by the natives as food.

HIPPOLYTE GIBBEROSUS, *M. Edw.*

Hippolyte gibberosus (M. Edw.), Dana, Crust. U.S. Explor. Exped., i., p. 565, pl. xxxvi., fig. 4.

One female with ova, the dorsal spines on the carapace are furnished with hairs similar to those between the spines of the upper and lower margins of the rostrum.

ALPHEUS EDWARDSII, *Audouin.*

Alpheus edwardsii (Audouin), Dana, Crust. U.S. Explor. Exped., i., p. 542, pl. xxxiv., fig. 2.

Five specimens.

ALPHEUS LEVIS, *Randall.*

Alpheus levis (Randall), Dana, Crust. U.S. Explor. Exped., i., p. 556, pl. xxx., fig. 8.

One specimen.

BETEUS MINUTUS, sp. nov.

(Plate vii., fig. 4, a, b.)

The carapace and abdomen is slightly compressed, smooth, and shining. Front with a short rostrum, which is broad at the base and acute at the apex. On each side of the base is situated a shallow sinus, bounded externally by a minute denticle.

The antero-lateral frontal margin is straight from the internal denticle to the outer angle, which is slightly produced. The inferior margin of the branchial walls forms a gentle curve from the front to the rounded posterior angle.

The peduncles of the first antennæ are stout and a little longer than the peduncles of the second. The first joint is gibbous in the middle internally, it is longer than the second, and nearly twice as long as the last, the lanceolate basal scale slightly exceeds the extremity of the first joint. The flagella are ciliated and subequal, the inner with a short lobe bordered by six tufts of filaments. The peduncles of the second antennæ as long as the scale, the latter is internally ciliate and externally armed with a short spine near the distal end, which however falls short of the foliate apex.

The last joint of the peduncle is very long and equal to the external margin of the scale, the joint bearing the antennal scale has a spine on its inner distal extremity. The chelæ of the first pair of legs are equal. The ischium and merus are subtrigonal, the former slightly longer than the carpus, the latter as long as the carpus and the hand combined (fingers excluded). The carpus is obconical with the distal edge smooth and even. The palm of the hand is a little compressed, swollen in the middle and as long as the mobile finger. An ill-defined longitudinal line extends from the base of the immobile finger along the palm, fading away a short distance from the proximal end.

The fingers are sub-equal, a little curved, meeting along their edges when closed, and furnished with a few tufts of hairs at their extremities. The carpus of the second pair of legs is five-jointed, the first is the longest, the third and fifth are equal, whilst the fourth is the shortest.

The propodal joints of the fifth pair of legs more elongate than those of the third and fourth.

The dactyli are short and slightly curved at their extremities.

The telson is somewhat cunate, shorter than the uropoda, with two spines on each side close to the margin, and four at the truncated extremity, the inner pair of which are much the longest.

The inner ramus of the caudal appendages is much narrower than the outer, the latter with a broad scale-like spine at the base, and three at the outer distal extremity, the median one is

large, slightly curved and inserted close to the outer and smallest of the spines.

The inner branch of the pleopoda in the female has a short club-shaped process, situated on the margin in the middle or at a short distance below.

The legs are slightly hairy, when alive the specimens were of a reddish-sand colour, in spirit the posterior two-thirds of the carapace is scarlet, the abdominal segments are also tinted on the upper surface with the same colour.

About fifty specimens were obtained under stones and in sponges in the mangrove swamp.

Length of largest specimen from the tip of the	
rostrum to extremity of telson	14mm.
Length of external antennæ.....	15mm.
Length of chelipedes.....	6mm.
Length of hand and fingers.....	2½mm.
Length of fifth leg.....	7½mm.

HARPILIUS MIERSI, *De Mann*.

Harpilius miersi, De Mann, Journ. Linn. Soc., Zool., xxii., p. 274, pl. xvii., figs. 6-10.

Two females somewhat doubtfully referred to De Mann's species.

The specimens seem to differ slightly from the type as figured by the author.

The rostrum is five or rather seven toothed if the terminal and inferior teeth are included, they occupy the same relative positions to each other as those on the rostrum figured by De Mann. The small processes of the frontal margin between the insertion of the external antennæ and the eye-stalks can scarcely be termed spinose, they consist of thin projections of the frontal margin of the carapace.

The colour of the specimens preserved in formol when received was a light cream with bluish spots, similar to Dana's figure of *Ædipus superbus*, the spots were uniformly distributed over the whole body and appendages.

Total length of largest specimen 25mm., rostrum and telson included.

Tribe STOMATOPODA.

GONODACTYLUS CHIRAGRA, *Fabr.*

Gonodactylus chiragra (Fabr.), Dana, Crust. U.S. Explor. Exped., i., p. 623, pl. xli., fig. 5.

One specimen.

*Tribe ISOPODA.**Cirolana latystylis*, Dana.

Cirolana latystylis, Dana, Crust. U.S. Explor. Exped., ii., p. 772, pl. li., fig. 6.

Twelve examples of this rare species were obtained on sponges in sandy pools.

*Tribe EPICARIDEA.**ATHELGUE ANICULI*, sp. nov.

(Plate vii., fig. 5, a, b, c.)

Body oval, twice as long as broad, slightly transversely convex above and depressed below.

Upper antennæ short, with two exposed joints and a short flagellum, surmounted by a pencil of setæ, the last joint equal in length to the third joint of the outer antennæ; the latter with four joints, the first short, broad and boss-like, the second stout, elongate and equal to the last, which is rather slender, third joint a little longer than broad, the flagellum is slightly longer than the breadth of the last joint and ends in a tuft of hairs.

Immediately posterior to the upper antennæ is situated a transverse lip-like process (the frontal edge of the cephalon) which extends to between the bases of the second antennæ and of the first pair of legs. Eyes not discernible.

The cephalic shield is separated from the frontal margin by a slight groove, its anterior edge is almost straight, the antero-lateral angles are oblique and in contact with the bases of the first pair of legs, the posterior margin is evenly rounded.

The segments of the peræon are rather indistinct ventrally, but well marked dorsally, the first segment scarcely visible behind and almost in contact with the cephalic shield, the second much longer than the first, the third and fourth equal; fifth and sixth a little longer and broader than the preceding pair, seventh equal in length but considerably narrower than the sixth.

On the posterior margins of each segment there are a pair of flat triangular teeth, directed towards the pleon, they form two longitudinal rows, and are situated nearer the bases of the legs than the median line of the body, the first and last pairs are small, the intermediate pairs subequal.

The legs are curved over towards the dorsal surface, and—excepting the first pair—are equal in length, the first five are equidistant, a rather wide space exists between the fifth and sixth. The short basal joints are tumid, and have a short lobe which is acute in the last three pairs, second joints of the fifth,

sixth and seventh legs, have a bead-shaped elevation on the posterior surface a little below the middle; third joints shorter than the second, and in all the legs more or less produced and lobate at the infero-distal extremities; fourth joints short, the fifth bent over and opposable to the distal lobe of the third joint, sixth joint minute, triangular, and opposed to a projection of the propodus.

The first and second segments of the pleon are as long but not quite so broad as the last segment of the peræon, the fourth is about half the size of the third, fifth and sixth very short and subcylindrical, the latter terminating abruptly, and bearing a pair of minute lanceolate appendages.

The pleopoda are inserted on the margins of the pleon. They are pedunculate and consist of sixteen foliate plates; the first joint is about twice as long as broad, the outer and inner rami are situated at its distal extremity, the inner ramus is obovate and almost sessile, the outer with a peduncle as long or longer than the basal joint, the lamina is subfalcate with an even curve on the outer margin, its inner straight distally and lobate proximally; the fourth outer ramus is a little shorter than the peræon.

The first pair of marsupial plates is folded in front of the head so as to produce a kind of funnel, consisting of two spout-shaped lobes; posteriorly on the ventral surface they are produced and form a pair of subfalcate blades, which are evidently of a vibratory character and seem well adapted to drive a current of water through the brood pouch.

There are five pairs of functional marsupial plates, the second pair overlaps the falcate prolongations of the first pair, the posterior ciliate margins of the last and largest pair do not extend beyond the terminal segment of the peræon.

The colour of the peræon above and below, and of the lower surface of the pleon is light salmon yellow, the legs and the peduncles of the pleopods are yellowish-white, the pleopodal rami are opaque-white, with a few translucent lines radiating from the midrib; the anterior and posterior marsupial plates are somewhat opaque, the intermediate plates are translucent.

As the specific name implies, the host of this Epicarid is *Aniculus typicus*, which hermit crab invariably occupied the shell of *Turbo setosus*, Gmelin, and was never seen except at low water, on the edge of the outer reef most exposed to the surf, where it was rather rare. This most interesting parasite—the only one procured by the Expedition—was accidentally discovered on the anterior surface of the abdomen, near the hinder margin of the carapace. The host was drowned in fresh water, and when dead was found somewhat exserted from its shell, exposing

the epicarid to view. In one of the bottles was a specimen of what might possibly be the male of this species, but which is too much damaged for accurate description, and it is doubtful whether it really belongs to the *Athelgue*.

Total length	22mm.
Breadth	8mm.
Length of cephalon and peræon	11mm.
Length of pleon.....	6mm.
Breadth "	5mm.
Length of outer ramus of third and fourth pleopods, peduncle included.....	9mm.

CIRRIPIEDIA.

LITHOTRYA NICOBARICA, *Reinhardt*.

Lithotrya nicobarica (Reinhardt), Darwin, Mon. Cirripedia, i., p. 359, pl. viii., fig. 2.

Three specimens, the largest measures 64mm. in the total length, the smallest 22mm.

Found in crevices under large blocks of coral.

I owe the accompanying illustrations to my colleague, Mr. Edgar R. Waite, from whose careful drawings they were reproduced by lithography.

THE ECHINODERMATA OF FUNAFUTI.

BY THOMAS WHITELEGGE,

Zoologist, Australian Museum.

THE ECHINODERMATA.

BY THOMAS WHITELEGGE.

THE Collection of Echinodermata comprises one hundred and thirty specimens representing nineteen species, most of which belong to well known forms, common to the Pacific coral reefs.

Although devoid of new species, the material includes a few rare examples of great interest not hitherto represented in the Museum Collection.

The following are the Orders represented :—

					Species.
Echinoidea	...	...	...	...	7
Asteroidea	...	...	...	...	3
Ophiuroidea	...	...	...	...	3
Holothuroidea	...	...	...	...	6

The species of interest are *Echinothrix turcarum*, *Echinometra oblonga*, *Laganum depressum*, *Ophidiaster cylindricus*, *Culcita acutispinosa*, *Ophiarthrum elegans*, and *Holothuria imitans*.

The *Culcita acutispinosa* has been noticed at some length, and the non-specific value of external form has also been pointed out. In a subsequent article by Mr. Waite a note will be found on the commensalism of *Fierasfer* with *Holothuria argus*. Mr. Saville Kent has recorded a species of *Fierasfer* as occurring in the body cavity of *Holothuria mammifera*, on the Queensland coast.* In this connection I venture to suggest that future observers should try to ascertain if *Fierasfer* is ever found in members of the genus *Muelleria*. Possibly the presence of anal teeth in *Muelleria* may be of use in excluding the fish from the body cavity.

ECHINODERMATA.

ECHINOIDEA.

ECHINOTHRIX TURCARUM, Schynv.

Echinothrix turcarum (Schynv.), Agassiz, Rev. Echini, Mem. Mus. Comp. Zool., iii., p. 416, pl. 111a, fig. 3.

Six specimens, in the two largest the spines are of a uniform dark colour, whilst the four smaller examples have the spines

* Saville Kent—Great Barrier Reef, 1893, p. 240.

annulated with from five to nine whitish bands a little narrower than the intervening dark bands, except in the youngest specimens, which have them about equal in width.

Diameter of test of largest example.....	92mm.
Height " " 	48mm.
Diameter of smallest example.....	25mm.
Height " " 	11mm.

Native name, "Vanna."

HETEROCENTROTUS MAMILLATUS, *Klein.*

Heterocentrotus mamillatus (Klein), Agassiz, Rev. Echini, *l. c.*, iii., p. 428.

Only a few spines of this species were obtained; there is a fine specimen in the Museum Collection, from the Ellice Group, collected and presented by Dr. Luther, of H.M.S. "Dart."

Native name, "Fatuki."

ECHINOMETRA LUCUNTER, *Leske.*

Echinometra lucunter (Leske), Agassiz, Rev. Echini, iii., *l. c.*, p. 431.

One specimen.

This species is exceedingly common on the outer reefs and in the lagoon.

ECHINOMETRA OBLONGA, *Blainv.*

Echinometra oblonga (Blainv.), Agassiz, Rev. Echini, *l. c.*, iii., p. 433.

Nine specimens were obtained. Common on the outer reefs and in the lagoon.

ECHINUS ANGULOSUS, *Leske.*

Echinus angulosus (Leske), Agassiz, Rev. Echini, *l. c.*, i., p. 122; *id.* iii., p. 489.

There are two very small specimens which I refer to this species, the largest example is only 12mm. in diameter.

LAGANUM DEPRESSUM, *Less.*

Laganum depressum (Less.), Agassiz, Rev. Echini, *l. c.*, iii., p. 518.

A very fine series consisting of sixteen specimens, found in company with the following species.

MARETIA PLANULATA, Lam.

Maretia planulata (Lam.), Agassiz, Rev. Echini, iii., l. c., p. 570.

Forty-eight examples, exhibiting great variation in colour; about one half of the specimens are of a uniform yellowish-white, the rest are more or less streaked or spotted with brown.

Dredged in abundance in thirteen fathoms of water in the lagoon, one mile west of the Mission Church.

ASTEROIDEA.

OPHIDIASTER CYLINDRICUS, Lam.

Ophidiaster cylindricus (Lam.), Perrier, Rev. Stellerides, Arch. de Zool. Exper., iv., p. 389; Loriol, Cat. Raisonné des Echin. Mém. Soc. Phys. et Hist. Nat. Gèneve, xxix., 4, p. 20, pl. xi., figs. 3-4.

Two specimens obtained under stones on the leeward or western side of the Atoll.

LINCKIA PACIFICA, Gray.

Linckia pacifica, Gray, Ann. & Mag. Nat. Hist., vi., 1840, p. 285; Perrier, l. c., iv., p. 404.

Three examples, which were a brilliant blue colour when alive. Common in the lagoon.

Native name, "Munga-munga ti."

CULCITA ACUTISPINA, Jef. Bell.

Culcita acutispina, Jef. Bell, Ann. & Mag. Nat. Hist. (5), xii., p. 334.

To this species are referred, though with some hesitation, two specimens obtained in the lagoon. Generally both examples agree with the description given by the author, there are, however, a few characters present which are only slightly touched upon in the original diagnosis.

In the larger specimen the adambulacral spines are in two rows, the inner consisting of four or five spines to each plate; they are a little compressed, the central three being the longest. The outer row consists of two spines to each plate which are very unequal in size, the one nearest the actinostome is large, bluntly conical, and not as a rule higher than broad at the base. The smaller outer spine is almost undistinguishable from the granules which beset the surface generally; occasionally, however, they are more evident, and resemble the larger spines of the inner row.

The central interambulacral space of the actinal surface is closely studded with bead-like granules, varying in size from one to two millimetres in diameter. They are not seriate but scattered irregularly, and are either in contact with each other at the base or separated by a few granules.

On the space near the mouth angle, along the ambulacral groove and on the sides below the porous areas, the large granules are mostly acute, about as high as broad, and are at least their own diameter apart.

The sides of the porous areas and the whole of the abactinal surface is furnished with spines, narrower at the base and more acute than any of those on the actinal surface. The larger spines are mostly confined to the interporous spaces, and—in the large specimen under notice—give the upper surface a reticulate appearance.

In the smaller example the large acute spines are scattered over the porous and non-porous areas alike, and the areolate feature visible in the larger specimen is wanting. These spines are usually a little higher than broad, and two or three times their diameter apart.

The porous areas are densely packed with short acute spines, subspiniiform granules and pedicellariæ, the latter are about two-thirds of a millimetre in length; when viewed from the lateral aspect they are seen to be slightly convex externally and meeting only at their tips.

Each pedicel is narrow in the middle with the base and apex dilated, the latter has its inner surface excavated, and the semi-circular margin minutely denticulated. The pedicellariæ are much more abundant on the lower half of the abactinal surface than in the upper central region,—usually from six to ten in a centimetre,—they are mostly confined to the porous areas, but occasionally they occur on the interporous spaces.

The minute granules on the abactinal surface are more or less acute and a little longer than broad at the base. The somewhat larger granules on the actinal surface are also mostly acute and about as high as broad; very few are rounded at the summit.

The pedicellariæ on the actinal surface are not very abundant, the majority are elevated a little above the adjacent granules, and present when closed an almost circular outline, some of the larger, however, are a little elongated.

Owing to their slight elevation, larger size, and lighter colour, the actinal pedicellariæ are quite conspicuous and easily distinguished from the small granules.

The madreporic plate is oval in shape, and has a few conical spines around its margin, similar spines surround the anus, and in the larger specimen some of the spines are granulose at the apex.

The number of marginal pore areas in the interambulacral space is thirteen in both specimens. From the margin to the anus there are nine or ten pore areas, and from the tip of the ambulacral groove to the anus there are seven in the large specimen. In the smaller example they are fewer, being eight or nine in the interambulacral space, and five from the apex of the arm to the anus.

There are seventy clusters of adambulacral spines along each side of the ambulacral groove, counting from the mouth angle to the end of the groove.

The following are the measurements of both examples:—

Large specimen.....R., 155mm. ; r., 100mm.

Small ditto.....R., 115mm. ; r., 85mm.

R., measured along the side of the groove from mouth angle to the extremity of the arm ; r., from mouth to commencement of pore areas.

Diameter, large specimen.....220mm.

Height " " 85mm.

Diameter, small specimen.....172mm.

Height " " 60mm.

An examination of the members of the genus *Culcita* shows that it is greatly in need of revision ; too much attention has been paid to the outward form, which presents characters of little specific value.

If a specimen is obtained and placed in a vessel with sea water, and allowed to assume a symmetrical shape, and afterwards killed in strong spirit, when thoroughly preserved it may be dried and will retain its shape, having the abactinal surface convex. If on the other hand it is plunged direct into strong alcohol without regard to its shape, it will retain its original and often very unsymmetrical form. Cake-like or flat examples are in most cases due either to drying without previous curing in spirits, or drying after being in very weak spirit.

In *Anthenea acuta*, Perrier—common in Port Jackson—we have a good example in illustration of the above remarks.

This species often attains to nine or ten inches in diameter, and is a most variable species as far as the convexity of the abactinal surface is concerned and in the granulation. Having trawled thousands of specimens, and noted that, however unsymmetrical when brought up in the trawl, if placed on a level surface in a little sea water they soon regain their natural form, and may be killed in that state either by flooding them with fresh water or by placing them in strong spirit.

It has often happened when we have obtained the *Anthea* in abundance that some have been lying about the deck, others entangled in the trawl, or buried beneath the seaweeds for many hours. Ultimately these specimens have been hastily gathered up and placed in spirits, resulting in a series of distorted examples, which would be very misleading to a worker unacquainted with the form of a well preserved specimen.

The following are the measurements of four specimens of *Anthea acuta*, Perr., showing the differences due to the mode of preservation :—

R.....130mm.	R.....115mm.	} Well preserved.
r..... 63mm.	r..... 65mm.	
Height 50mm.	Height 37mm.	
R.....110mm.	R.....113mm.	} Badly preserved.
r..... 50mm.	r..... 65mm.	
Height 17mm.	Height 20mm.	

OPHIUROIDEA.

OPHIOCOMA SCOLOPENDRINA, Agass.

Ophiocoma scolopendrina, Agass., Mém. Soc. Sci. Nat. Neuchatel, i., p. 192, 1835; Lyman, Chall. Rep. Zool., v., p. 170, pl. xlvii., fig. 3.

One half grown specimen.

OPHIOCOMA ERINACEUS, Müll. & Trosch.

Ophiocoma erinaceus, Müll. & Trosch., Syst. Asteriden, p. 94, 1842; Lyman, Ill. Cat. Mus. Com. Zool., i., 1865, p. 85.

Twenty-two examples, mostly young.

OPHIARTHURUM ELEGANS, Peters.

Ophiarthrum elegans, Peters, Monatsb., K. Akad. Wiss. Berlin, 1851, p. 464.

One half grown specimen.

HOLOTHUROIDEA.

MUELLERIA ECHINITES, Jaeger.

Muelleria echinites, Jaeger, De Holoth., 1883, pp. 17-18, pl. iii., fig. 6; Semper, Reisen Arch. Phil. Holoth., 1868, p. 76, pl. xxx., fig. 8.

One specimen obtained at low water line on the outer reef. Native name, "Funafuna."

HOLOTHURIA ARGUS, Jaeger.

Holothuria argus, Jaeger, De Holoth., 1833, p. 19, pl. ii., fig. 1 ; Semper, Reisen Arch. Phil. Holoth., 1868, p. 80, pl. xxx., fig. 11 ; Saville Kent, Great Barrier Reef, p. 56, p. 238, pl. xii., fig. 7.

One example, found on a sandy bottom in the lagoon, where it was fairly common.

HOLOTHURIA ATRA, Jaeger.

Holothuria atra, Jaeger, De Holoth., 1833, p. 22 ; Semper, Reisen Arch. Phil. Holoth., 1868, p. 88, pl. xxvi. ; Théel, Chall. Rep., Zool., xiv., p. 181, pl. vii., fig. 4.

Four specimens ; very abundant on the outer reefs.

Native name, "Malorli."

HOLOTHURIA VAGABUNDA, Selenka.

Holothuria vagabunda, Selenka, Beiträge Anat. Syst. Holoth., Zeits. f. Wiss. Zool., xvii., 1867, p. 334, pl. xix., figs. 75-76 ; Semper, Reisen Arch. Phil. Holoth., 1868, p. 88, pl. xxi. ; Lampert in Semper's Reisen Arch. Phil., iv., p. 71, pl. i., figs. 3-19.

Two specimens, obtained in the mangrove swamps under stones at low tide.

HOLOTHURIA PARDALIS, Selenka.

Holothuria pardalis, Selenka, Beiträge, Anat. Syst. Holoth. Zeits. f. Wiss. Zool., xvii., 1867, p. 336, pl. xix., fig. 85 ; Semper, Reisen Arch. Phil. Holoth., 1868, p. 87, pl. xxx., fig. 31.

Four specimens, obtained in the mangrove swamps.

HOLOTHURIA IMITANS, Ludwig.

Holothuria imitans, Ludwig, Arb. Zool. Zoot. Inst. Wurzburg, ii., 1875, p. 109, pl. vii., fig. 41 ; Lampert in Semper's Reisen Arch. Phil., iv., p. 80.

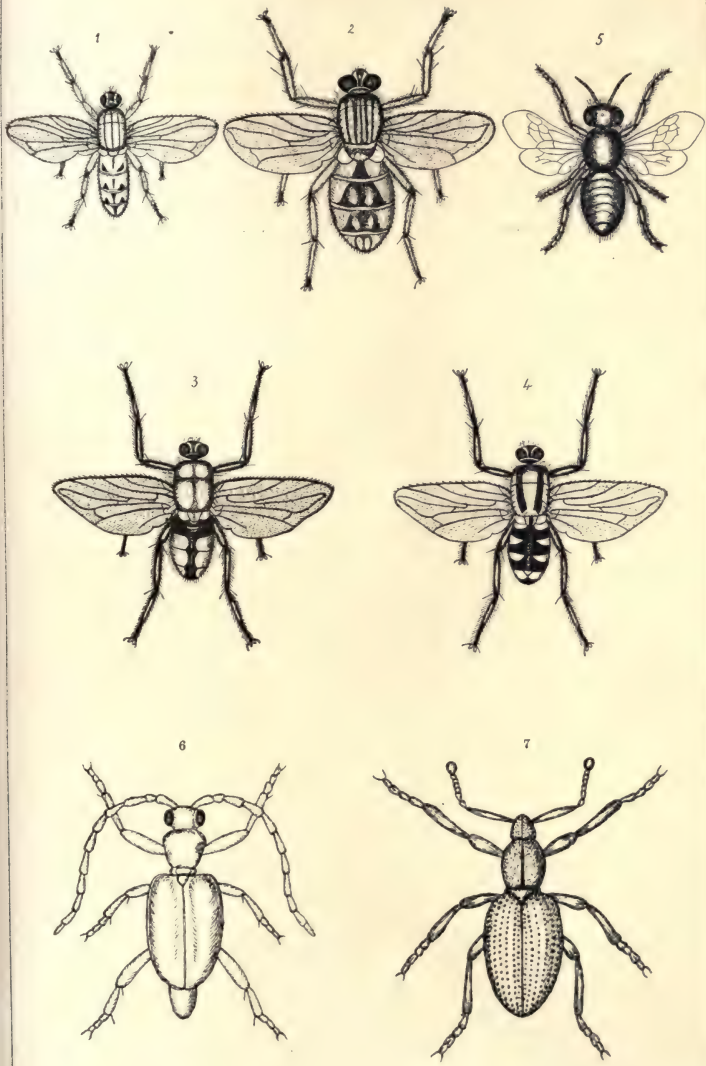
With some hesitation I refer to this species five small specimens, which agree in the main with the descriptions given by Ludwig, Lampert, and Théel.

The tentacles are twenty in number, the colour is dark brown, the deposits consist of curved bars and tables. The bars appear to be confined to the ambulacral appendages and to the tentacles ;

in the former the bars have processes on each side which often join, forming a series of more or less complete holes ; in the latter the bars are strongly curved, and have very small processes along the convex edges and ends only the concave side is smooth. The tables have the smaller four toothed ends pointed outwards towards the skin, the inner and very much larger ends have eight teeth or rather four pairs, each pair being closer together than the space separating them ; these teeth are often dilated and denticulate at the ends.

EXPLANATION OF PLATE I.

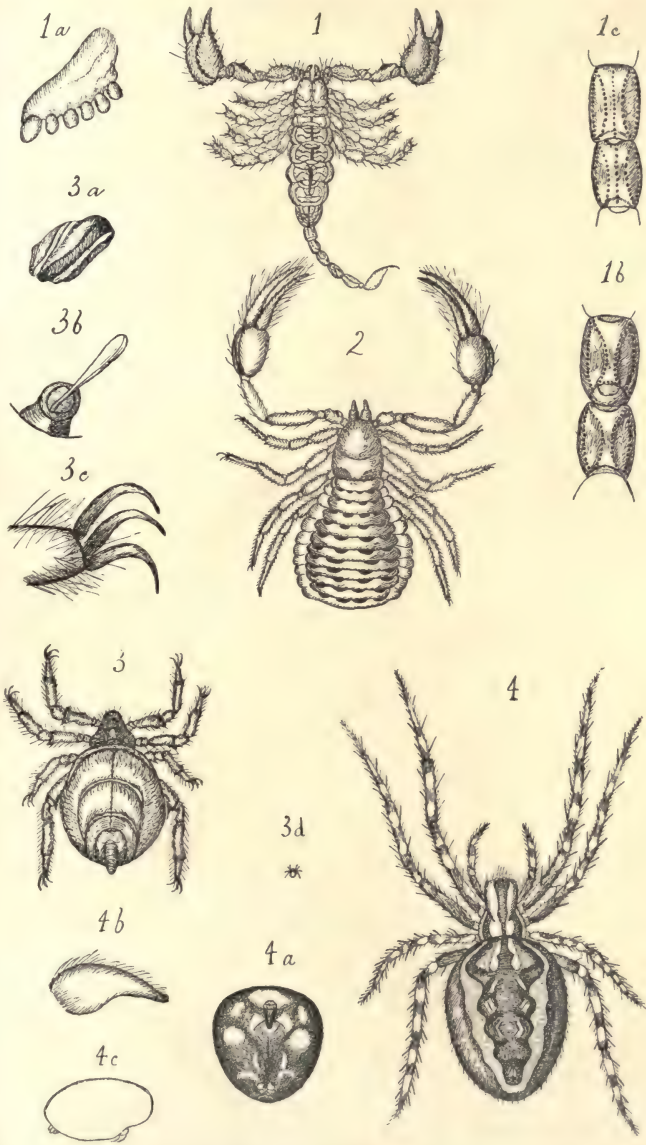
- Fig. 1. *Lispe vittata*, Rainb.
,, 2. *Degeeria dawsoni*, Rainb.
,, 3. *Ebenia nigricruris*, Rainb.
,, 4. „ *fieldi*, Rainb.
,, 5. *Megachile hedleyi*, Rainb.
,, 6. *Nacerdes transmarina*, Rainb.
,, 7. *Elytrurus squamatus*, Rainb.



EXPLANATION OF PLATE II.

Fig. 1. *Buthus brevicaudatus*, Rainb.

- | | | | |
|-------|---|---|--|
| „ 1a. | „ | „ | comb. |
| „ 1b. | „ | „ | 2nd & 3rd segment of tail, superior surface. |
| „ 1c. | „ | „ | „ „ inferior surface. |
| „ 2. | <i>Chelifer longidigitatus</i> , Rainb. | | |
| „ 3. | <i>Oribata lamellata</i> , Rainb. | | |
| „ 3a. | „ | „ | abdomen, side view. |
| „ 3b. | „ | „ | pseudo-stigmata. |
| „ 3c. | „ | „ | tarsus. |
| „ 3d. | „ | „ | natural size. |
| „ 4. | <i>Epeira ventricosa</i> , ♀, Rainb. | | |
| „ 4a. | „ | „ | underside of abdomen. |
| „ 4b. | „ | „ | epigyne, side view. |
| „ 4c. | „ | „ | abdomen, in profile. |



EXPLANATION OF PLATE III.

Fig. 1. *Epeira longispina*, ♀, Rainb.

„ 1a. „ „ abdomen, side view.

„ 1b. „ „ epigyne.

„ 2. „ „ ♂ (immature), Rainb.

„ 3. *Epeira multispina*, ♀, Rainb.

„ 3a. „ „ abdomen, side view.

„ 3b. „ „ epigyne.

„ 3c. „ „ falx.

„ 4. „ „ ♂, Rainb.

„ 4a. „ „ trochanter of second pair of legs, underside.

„ 4b. „ „ femur of do., underside.

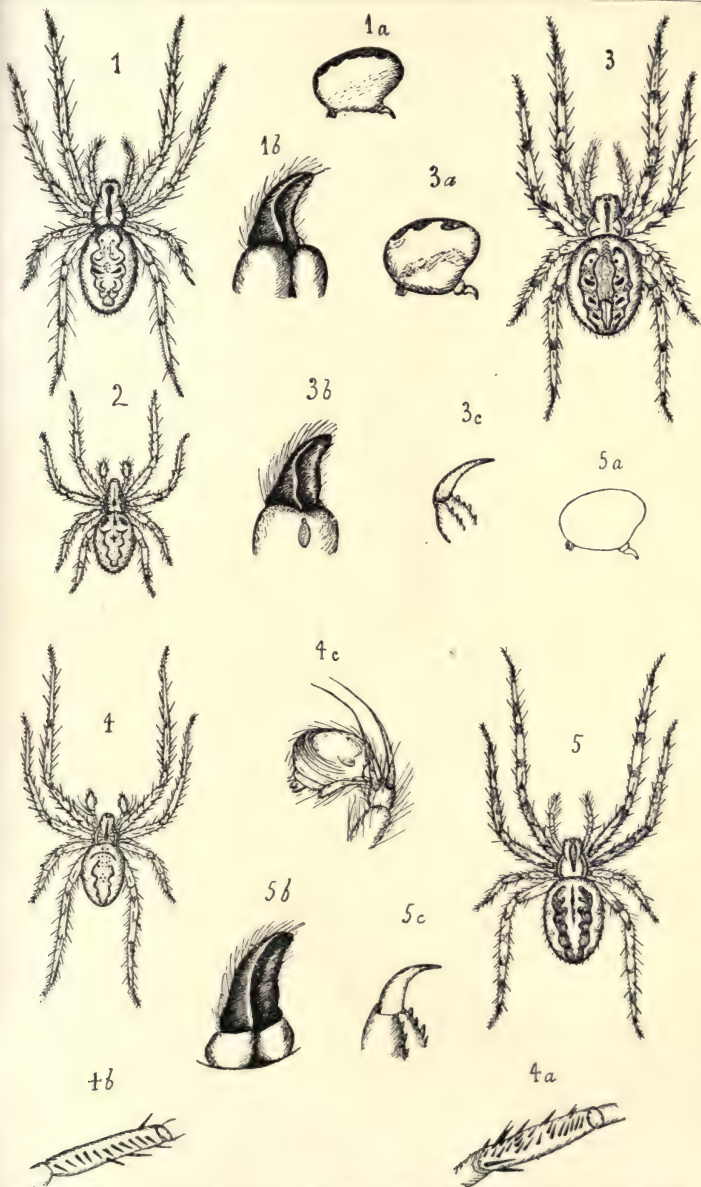
„ 4c. „ „ right palpus, viewed from above.

„ 5. *Epeira etheridgei*, ♀, Rainb.

„ 5a. „ „ abdomen, side view.

„ 5b. „ „ epigyne.

„ 5c. „ „ falx.

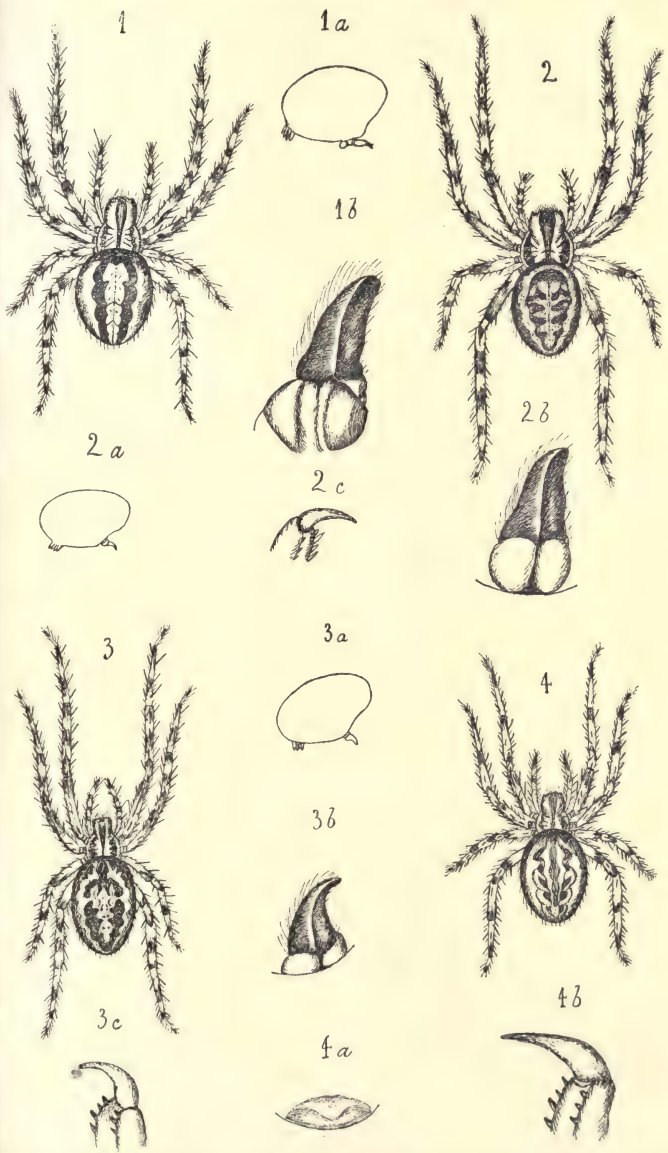






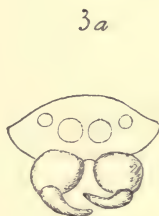
EXPLANATION OF PLATE IV.

- Fig. 1. *Epeira festiva*, ♀, Rainb.
,, 1a. ,, ,, abdomen, side view.
,, 1b. ,, ,, epigyne.
,, 2. *Epeira obscura*, ♀, Rainb.
,, 2a. ,, ,, abdomen, side view.
,, 2b. ,, ,, epigyne.
,, 2c. ,, ,, falx.
,, 3. *Epeira annulipes*, ♀, Rainb.
,, 3a. ,, ,, abdomen, side view.
,, 3b. ,, ,, epigyne.
,, 3c. ,, ,, falx.
,, 4. *Epeira distincta*, ♀, Rainb.
,, 4a. ,, ,, epigyne.
,, 4b. ,, ,, falx.



EXPLANATION OF PLATE V.

- Fig. 1. *Epeira hoggi*, ♀, Rainb.
" 1a. " " epigyne.
" 2. *Epeira speciosa*, ♀, Rainb.
" 2a. " " epigyne.
" 3. *Hyllus ferox*, ♀, Rainb.
" 3a. " " falces and front row of eyes.
" 3b. " " falx.
" 3c. " " epigyne.
" 4. *Hyllus audax*, ♀, Rainb.
" 4a. " " epigyne.





EXPLANATION OF PLATE VI.

Fig. 1. *Pilumnus prunosus*. x 2.

„ 1a. „ „ right chelipede. x 3.

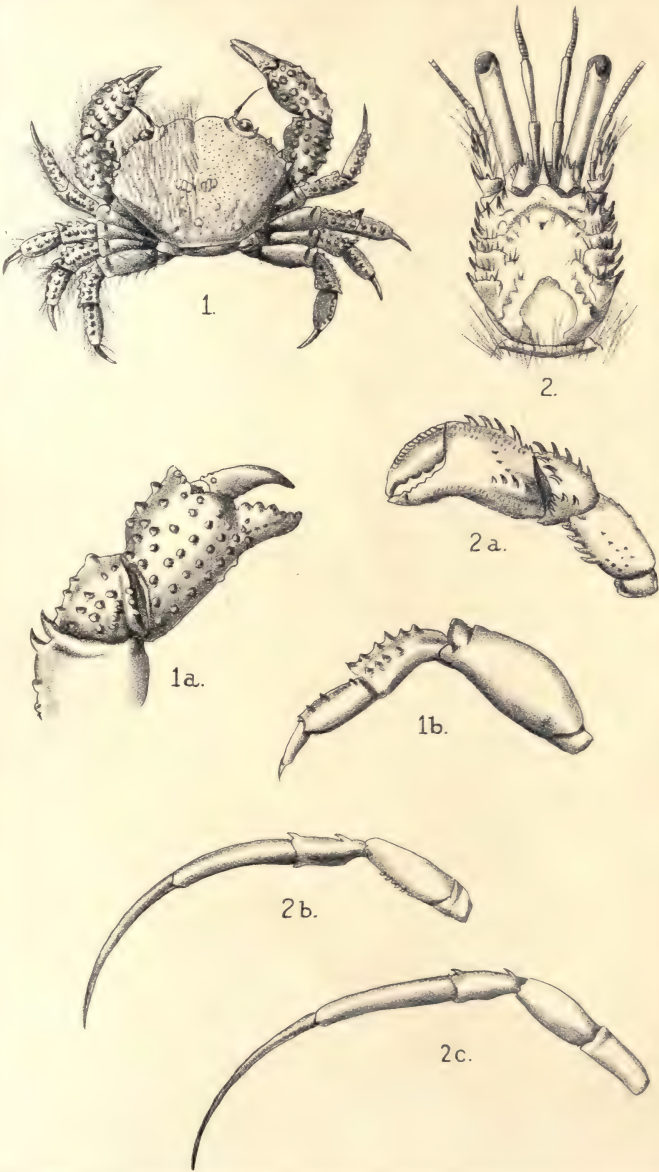
„ 1b. „ „ first left leg. x 4.

„ 2. *Diogenes pallescens*. x 8.

„ 2a. „ „ left chelipede. x 5.

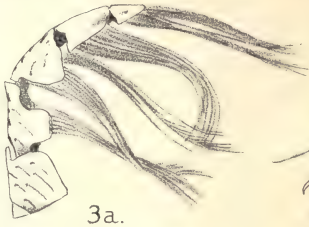
„ 2b. „ „ first left leg. x 6.

„ 2c. „ „ second left leg. x 6.



EXPLANATION OF PLATE VII.

- Fig. 3. *Porcellana sollasi*. x 6.
- | | | | | |
|-------|---------------------------|---|-----------------------------|-------|
| „ 3a. | „ | „ | right external maxillipede. | x 10. |
| „ 4. | <i>Betæus minutus</i> . | | | x 5. |
| „ 4a. | „ | „ | telson and uropods. | x 8. |
| „ 4b. | „ | „ | rostrum. | |
| „ 5. | <i>Athelgue aniculi</i> , | | | x 3. |
| „ 5a. | „ | „ | vibratory appendages. | x 3. |
| „ 5b. | „ | „ | sixth leg. | x 10. |
| „ 5c. | „ | „ | third pleopod. | x 4. |



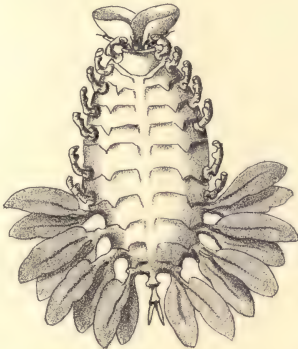
3a.



3.



5a.



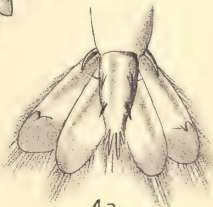
5.



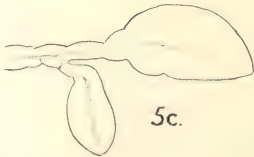
4b.



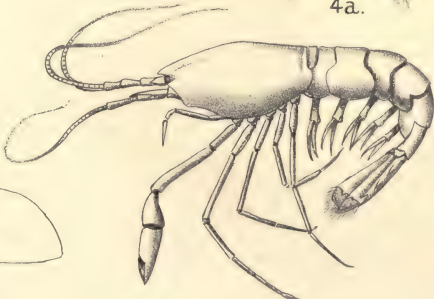
5b.



4a.



5c.



4.

THE MAMMALS, REPTILES, AND FISHES
OF FUNAFUTI.

By EDGAR R. WAITE, F.L.S.,

Zoologist, Australian Museum.

[VIII.]

THE MAMMALS, REPTILES, AND FISHES.

BY EDGAR R. WAITE, F.L.S.,

Zoologist, Australian Museum.

[Plate VIII.]

EXCLUDING the Birds, the indigenous terrestrial Vertebrate fauna of the Funafuti Atoll appears to be comprised in five species:—a rat and four lizards. Introduced, are the European rat and mouse, of which, however, examples were not obtained for certain identification; and, as domestic animals, the pig and cat.

Dogs, now unknown on the Atoll, were at one time common, but were purposely exterminated, the reason, according to Moss, being as follows*:—"At Funafuti the Turimen march round the village during the night, and quietly steal into the houses to see if all is right. It was found that the house dogs barked and gave notice of their approach, so they forthwith decreed the destruction of all dogs on the island and again became masters of the situation."

Of marine animals, we are told that "Porpoises" are common off the coast at certain periods,† and that a turtle is also occasionally obtained; Bats, Crocodiles, Ophidians, and Batrachians are unknown.

There being no fresh water on the Atoll beyond what the inhabitants can obtain by artificially arresting the rainfall, the Fish fauna is represented only by marine forms. Of these a fair number was collected, and indirect evidence respecting a few others is noted in the accompanying list.

MAMMALS.

Much of the literature of the Pacific Islands contains some mention of a native rat, described as living in the bush or infesting the houses and feeding upon vegetables and fruit, but for the

* Moss—Through Atolls and Islands in the Great South Sea, 1889, p. 118.

† See p. 67, "General Account."

most part no scientific description of the animal is attempted, nor is reference made to previous records in other islands. Although the rat is frequently mentioned, it has not in all cases been thought of sufficient interest to be indexed, and therefore many possible records are not apparent. The geographical distribution of the Pacific rat is so wide, and therefore of such interest, that I have thought it wise to include all definite localities met with during casual reading, to form a basis on which to build.

Before doing so, however, some notice of its identity is necessary.

IDENTITY.

Apart from the Maori rat, the only technical notice appears to be that by Peale,^{18*} who named (and figured) rats obtained from widely separated islands as *Mus exulans*. In this connection it may be mentioned that the Editor of the second edition of the work cited, remarks that he is not without suspicion that the animal is either *Mus pencillatus*, Gould,† or *Mus jacobiaæ*, Waterh.‡ There is, however, small likelihood of the Pacific rat being identical with either of these species, and indeed Thomas,²² by adopting Peale's name, has practically decided that it is distinct. His interesting note reads as follows:—

"The Rats from Sunday Island, Kermadec group, apparently belong to a species widely spread over the Pacific, the earliest name of which seems to be *Mus exulans*, Peale, based on Fijian examples. It is possible that examples from the different groups of islands may hereafter show certain differences from each other, but, so far as we can see at present, all should be united under one heading. Indeed the fine Maori Rat of New Zealand (*Mus maorium*, Hutton) seems to be very doubtfully separable from the same form, which has probably travelled from island to island in native canoes, or on floating logs &c., long before European ships began to bring over the ubiquitous Grey and Black Rats, which now threaten to exterminate the native species throughout the world."

It will be remarked that Fiji is not included in the localities enumerated by Peale at which *Mus exulans* was obtained: for rats from this group that writer proposed another name—*Mus vitiensis*; there can be little doubt, however, that notwithstanding the slight differences mentioned, the two forms are not specifically distinct.

* A List of Works referred to will be found on p. 177.

† Gould—Proc. Zool. Soc., 1842, p. 12.

‡ Waterhouse—Voy. "Beagle," Mam., 1840, p. 34.

All circumstances being taken into account, it appears probable that the Maori rat is also identical with this widely distributed Pacific species, and in one of his papers Hutton¹³ has pointedly remarked:—"It will be interesting to compare these skulls with specimens of the black rat* from Polynesia, for they will probably be found to be identical." And again, writing on *Mus novæ-zealandiæ*, Buller, he adds¹⁴ "There can, I think, be no doubt that these rats belong to the Polynesian variety." More recently Thomas has also expressed doubts as to the specific identity of the Maori rat, in the note previously quoted, and as mentioned by Buller,⁵ who further remarks that there are specimens of this form in the British Museum from the Fiji Islands, Norfolk Island, and New Caledonia. This view is supported by Maori tradition as related by Hochstetter,¹² to the effect that:—"the Kumara, or sweet potato (*Convolvulus batata*), the taro (*Arum esculentum*), the calabash-plant *Hue* (*Lagenaria vulgaris*), the Karaki tree (*Corynocarpus levigata*), the rat *Kiore*, the *Pukeko* (*Porphyrio*), and the green parrot *Kakariki*, are said to have been imported from Hawaiki." This traditional ancestral home is considered by modern Ethnologists to be Savaii, one of the Samoan Islands.

The New Zealand rat has a literature to itself, which will be found mainly in Trans. and Proc. N.Z. Institute. This literature I have not attempted to epitomise, and have referred to it only for odd records of habits. There is apparently still room for research among the New Zealand rats. The *Kiore* rat is said to be extinct, the *Mus maorium* to swarm, *vide* Meeson,¹⁷ Rutland,¹⁹ etc.

DISTRIBUTION.

If, as seems probable, the rat from all the Pacific Islands is referable to *Mus exulans*, the range of the species is very great indeed. Considering the native interchange which has taken place between islands hundreds of miles apart for ages past, this is not so remarkable as would at first sight appear.

For a long distance in the West Pacific there runs an enormous chain of islands, extending in a semi-circular sweep from the Marshall Archipelago, north of the equator to the Austral or Tubai Islands in the south-east. Our colleague has written of this as the Marshall-Austral chain, and dealt with it more particularly in his report.†

From each of the main links of this long chain of islands, we possess records of the occurrence of a native rat, as below enumerated.

* Our examples and also all other accounts agree in describing the colour of the Pacific rat as being similar to that of *Mus decumanus*, and not black as above indicated.

† See p. 3, "General Account."

Wake Island, an isolated atoll, which I would regard as an extension of the chain, is recorded by Peale,¹⁸ and is at the same time the most northerly and westerly (with New Caledonia) rat-inhabited island of which I have notice. Passing southward and westward the rat next appears to have been observed at Odia in the Marshall Group, and is represented by Kotzebue¹⁵ in an illustration as impudently trespassing in a Marshall Island house.

Continuing the chain, the rat is recorded from the Gilbert Group by Woodford,²⁵ who remarks that the only wild mammal he met with was a small species of rat common to the islands "in this part of the world."

The next group is that of the Ellice, of which the island of Funafuti at least, is tenanted, and supplied the examples, to be more fully described, and which prompted the present essay.

Mention has previously been made of Savaii being the traditional ancestral home of the Maori rat, but further evidence of its occurrence in Samoa is indicated by the reference to it in ancient tradition detailed by Turner,²³ and direct evidence is afforded²⁴ by this writer in the following note:—"The only indigenous quadruped is a small rat, something between a mouse and the Norwegian rat, the latter of which was introduced some years ago."

The last in the direct chain to which I have reference to the rat is the Cook Group, its occurrence being mentioned at Raratonga and Mangaia by Gill.^{9 & 10}

Of localities to the east of the main chain the following have been published. In the Phoenix Group Peale¹⁸ records it from Hull Island, and Arundel² from Sydney Island. Much further to the east it has been met with by Dixon⁷ at Malden Island, and also further to the south by Lamont, as quoted by Smith²¹ at Penhryn Island, and Dixon⁸ at Caroline Island, all isolated atolls. In the Paumotu Group or Low Archipelago Peale again records it from Disappointment and Dog Islands, and also from the Society Islands, remarking that the species was seen on but one "high" island, Tahiti.

Its north-eastern limit is suggested by a statement by Brigham³ that "Rats and mice have always been a pest on the Hawaiian Islands; and the old Hawaiian, before the introduction of cats, used a bow and arrows to destroy them. It is curious that knowing the principle of the bow they never used it as a weapon of offence, nor developed it beyond a very feeble instrument only suited to the killing of 'rats and mice and such small deer.'"

To the westward of the main chain Allardyce¹ records it from Rotumah, and it is once more mentioned by Peale from Fiji as *Mus vitiensis*, and from Hoonga in the Tonga Islands by

Mariner.¹⁶ The occurrence of a rat in the Kermadec Islands was first recorded by Smith,²⁰ who wrote:—"The only animal native to the island is a small grey rat, which is very plentiful in summer, but is supposed to hybernate during the winter. We saw one that had been partly eaten—by a hawk probably,—it was about five inches long." Thomas also received it from Sunday Island in this group, as already quoted. Away to the west it appears in New Caledonia, and again at Norfolk Island on the authority of Buller,⁵ who states that there are specimens in the British Museum from these localities.

The list of localities is closed by the inclusion of New Zealand as the most southern limit, and to which previous mention has been made in notices by Hutton, Thomas, Hochstetter, and others.

Although a systematic search of the literature of the Pacific Islands would doubtless disclose many more references to the rat, the above are the only definite localities I have so far met with. There is little doubt that the rat exists, or rather did exist, at one time or another on all the islands of the Pacific. Gill⁹ writing in 1876, and mentioning the islands of the South Seas as being inhabited by dogs, hogs, and rats, says:—"The rat alone is universal."

Arundel,² who called at many of the atolls in the Central Pacific, states:—"I have never visited an island, however small or barren, without finding these animals living upon it."

HABITS.

Unlike its European relative, the Pacific rat is usually said to feed only on vegetable substances. Writing of Mangaia, in the Cook Group, Gill⁹ states that it feeds exclusively upon cocoanuts, bananas, arrowroot, candle nuts, and papao (pawpaw) apples, and that it was usual to defend growing cocoanuts from the depredations of the native rat by making a sort of screen cleverly secured all round the tree, close to the fronds at a great height from the ground. In Mariner's¹⁶ book the rats are described as living chiefly upon such vegetable substances as sugar cane, bread fruit, etc., and it is incidentally mentioned that roasted cocoanut was used as a bait.

Peale¹⁸ adds the Pandanus to this list, and states that the fruit of this plant forms the principal food of the rat, hazarding the suggestion that if its appetite was at all carnivorous it would be found to feed upon the land crabs and molluscs on the shore, such however not being the case. He describes it (*Mus vitiensis*) as attacking pockets and packs containing edibles.

The Kioré Maori is described by Dieffenbach⁶ and others as being a frugivorous rat.

Rutland¹⁹ writes of the New Zealand bush-rat :—"Considering the vast numbers of these rats that periodically congregate round the homes of settlers in the bush, the mischief done by them is extremely small. This is owing to their food during the time being green vegetables. In kitchen gardens they are certainly annoying, devouring peas, beans, cabbages, and even onions, as they appear above ground, climbing up poles to nip off the shoots of the vines, etc."

Of Sydney Island Arundel² ascribes a partial animal diet to them, writing :—"Before any settlements are formed they live in the ground and roots of trees, and subsist on young birds, birds' eggs, seeds, etc. As soon, however, as anyone comes to live on an island they gather round the settlement, particularly round the native quarters, natives being, as a rule, rather wasteful in their eating, and scattering round about them rice, bread, pieces of fish, etc."

If the native rat preceded the human inhabitants of the atolls, the pandanus, being indigenous, would probably be its staple food, and as the cocoanut, breadfruit, arrowroot, etc., were introduced, the rat would acquire a taste for these articles.

As to its nesting habits the accounts are somewhat varied, Peale describes it as constructing a nest in the tussocks of grass, and making shallow burrows like an *Arvicola*. He describes *Mus vitiensis* as being a great pest in most of the houses of the Fiji Islands, making its nest in the thatched roof. Being an excellent climber it sallies forth at night in such numbers as to be exceedingly troublesome. Gill⁹ relates an instance of a pair having made a nest within a mummy conserved in a cave.

Of Caroline Island Dixon⁸ writes :—"The brown rat has a foot-hold, but is not numerous. Their nests were made in the cocoanut trees, just at the base of the fronds." Our colleague understood that it nested in similar situations in Funafuti.

In New Zealand, too, Rutland¹⁹ records how nests, evidently of rats, were found in the crowns of tree ferns and also under the roots of trees and among rushes. This writer describes the rats as being awkward on the ground but extremely active when climbing trees, ascending with the nimbleness of flies and running out to the very extremities of the branches. Hence, he adds, "when pursued they invariably make to trees if any are within reach." Peale mentions a similar habit in connection with the rats recorded by him.

In Tonga, Mariner¹⁶ describes it as being an inhabitant of the bush, writing :—"Every now and then the natives make a peculiar noise with the lips, like the squeaking of a rat, which frequently brings them out of the bushes."

In Mangaia, as mentioned by Gill,⁹ and as previously recorded, rats inhabited the mountain fern, whence they were occasionally

driven by fire. Arundel² describes the rats of Sydney Island as naturally living in the ground and roots of trees, but gathering round the dwellings as soon as a settlement is formed.

As elsewhere, the great enemy of the native rat is the common brown rat of Europe, introduced by ships throughout the world. Its depredations are such that Gill states that in many of the islands the indigenous breed has been exterminated by the imported rat. Some idea of the successful war waged by the introduced rat may be gathered from the following graphic account by the same writer⁹:—"In 1852 a solitary male Norway rat got ashore at Mangaia from the wreck of an American whaler. It made war upon the native rat, so that one of the bedrooms of the mission-house became uninhabitable. On removing the flooring about thirty dead native rats were found. We caught the offender in a trap."

Writing of Raratonga, another island of the Cook Group, the same author¹¹ incidentally records how the native rat has been subjected to even more deadly onslaught, being almost exterminated by the domestic cats which, originally introduced by missionaries and afterwards emigrating to the bush, took to hunting birds when rats became scarce.

On p. 59 of the present Memoir we read:—"Cats have long been introduced, they are known to the natives by the name of 'pussy,' and have proved of service in destroying the brown rat, formerly a great pest to the Islands." Dieffenbach,⁶ writing on New Zealand, states that the cat often runs wild and is another cause of the extermination of indigenous animals.

The natives themselves destroy the rats: first, as vermin; second, shooting them for sport; third, killing them for food.

When unchecked, rats became very numerous on some of the islands. Writing of Sydney Island, Arundel² mentions how on moonlight nights he has often seen hundreds of rats gathered together round the native quarters feeding upon waste rice, bread, pieces of fish, etc., thrown out. He adds that they frequently caught one hundred a night in tubs made into traps in the store.

In Mangaia they were also numerous, for Gill⁹ states that, like most of the Pacific Islands, it was literally overrun with rats, and describes how a large bottle-shaped hole was dug in the earth and baited with candle-nuts, adding that when the hole was pretty well filled with rats, two men would go down with knobbed sticks to kill them. A hole which would contain two men would accommodate a goodly number of rats! If the Mangaian rats were equally vicious with those mentioned by Peale, rat-killing under such conditions would not be unattended by danger, for he states that the animal resists pertinaciously and bites severely.

The reduction in the number of rats was a matter of such importance with the inhabitants, that we find a number of ingenious traps were in use for the purpose; these will be treated of in the Ethnological Report.

We have mentioned that sport may constitute a second way in which the rat is subject to persecution by the natives, Mariner¹⁶ has given an exhaustive account of the sport of "fanna gooma" or rat shooting, as practised on the island of Hoonga in the Tonga Group, from which it appears that it was an amusement in which only chiefs were permitted to participate, and was undertaken with much ceremony. The rats attracted by bait previously distributed, were shot with unfeathered arrows six feet long, projected from bows of similar length. The game was a party and not an individual affair, the party first killing ten rats was accounted the winner. If, Mariner adds, there be plenty of rats, they generally play three or four games. For a full account of the rules of the game the reader is referred to Mariner's book, which contains much of interest about the Tonga Islands. In Honolulu, as mentioned by Brigham,³ the bow was exclusively devoted to "killing rats and mice and such small deer."

The third reason for the native destruction of rats is of greater interest, and may be more fully mentioned.

In many of the islands of the Pacific the native rat formed an article of food with the inhabitants; feeding upon fruit or vegetables it would be less objectionable than the omnivorous European rat, and indeed Buller⁴ remarks that:—"Unlike the common rat, the rat of New Zealand is perfectly free from odour of any kind, probably due to the nature of its food, this consisting almost entirely of fruits and berries." The introduced rats were nowhere eaten: it may be that they were considered to be unpalatable, but it is equally possible that at the time they obtained a footing on the islands, pigs and other edible animals would also be introduced, and the necessity of eating rats removed. These native rats must have been considered good eating, for Gill,⁹ writing on the Cook Islands, states:—"The proverb 'sweet as a rat' survives in Mangaia to this day, although the adults of this generation have given up the disgusting practice of rat-eating."

This prolific and entertaining writer¹⁰ has given a valuable historical account of the capture and cooking of rats as practiced in Mangaia: it may be epitomised as follows:—

"In those days—ere the cat had been introduced—rats were very plentiful. Rat-hunting was the grave employment of bearded men, the flesh being regarded as most delicious. The rat, though but slightly larger than the English mouse, was the only quadruped on the island.

"Tamangoru, a solitary cannibal, on one occasion discovered two boys roasting a number of rats over a fire,—a joyful sight for a famishing Mangaian, he ambiguously remarked, 'cooked rats are capital eating.' The word 'rats' thus used might apply to the lads as well as to the little quadrupeds. A cooked boy would be indifferently called a 'fish' or a 'rat.'

"These two brothers subsisted chiefly by rat-catching, in which they were adepts.

"On the previous evening they dug a deep hole in the earth and covered the bottom of it with candlenuts, of which rats are excessively fond. A narrow pathway was made on either side for the rats to get down and eat. The lads lay in wait at a little distance, until they thought that the hole must be pretty full. Each lad carried a lighted torch in one hand, and a stout iron-wood stick in the other. They quickly killed a large number of rats.

"The boys now made a fire to roast the spoil. They then thrust long green reeds (previously prepared) through the rats, eight on each reed, and grilled them over the fire. There were four skewers or reeds of rats, that is, thirty-two in all. When the rats were done, the elder took two reeds of rats (sixteen) to Tamangoru; the famished man greedily devoured them and called for the remaining two reeds."

The same author⁹ informs us that in the neighbouring island of Raratonga, rats were not eaten, the inhabitants reviling the natives of Mangaia as the rat-eating Mangaians.

It would, however, appear that rats were not eaten when fish was procurable, for Gill relates how, when the sea was too rough for fishing, the boys set fire to the mountain fern, so that the rats rushing out of the fern, half blinded with fire and smoke, were easily killed with long sticks.

In Tonga (Hoonga Island) the rats formed an article of food with the lower orders of people, but in the account above referred to, Mariner¹⁶ says they are not allowed to make a sport of shooting them, this privilege being reserved for "chiefs, mata-booles, and mooas."

Of the rat in New Zealand, Dieffenbach⁶ tells us that the frugivorous Kioro Maori was formerly largely eaten by the natives, but that it had in 1843 become so scarce, owing to the extermination carried on against it by the European rat, that he could never obtain one.

Buller⁴ describes how during certain seasons the New Zealand rat was captured by thousands and eaten, or potted down in their own fat for future use.

At Penhryn Island, Smith²¹ informs us that the only animal on the atoll was a small rat, which was not eaten.

In Funafuti the native rat is described to me as having been driven from the village, and indeed almost exterminated upon the main islet by the foreign rat. Upon the other islets it exists and in some cases swarms, but as these islets are not permanently tenanted the rat can scarcely be regarded as a pest.

It constructs its nest in the cocoanut trees, just at the base of the fronds, and Mr. Hedley tells me that he frequently noticed the rats peeping out of the matting that sheathes the butts of the cocoanut fronds, and scampering about the heads of palms, fifteen or twenty feet high. In pre-civilised times these rats were a great plague to the natives, who did not use them as food. By law each individual was at times obliged to catch and destroy a set number of these vermin, for which purpose an ingenious trap was used.

NATIVE RAT.

MUS EXULANS, Peale.

Mus exulans, Peale, U.S. Expl. Exp., Mamm., 1st Ed., 1848, p. 47.

(Plate viii., figs. 1a-f.)

Fur fine, scanty, and of medium length; colour warm brown, reddish on the nape and back, basal half of the hair delicate grey, the tips yellowish or brown. On the back the fur is mixed with longer and comparatively thick hairs of bristly texture, these are white or very pale yellow throughout their length, the extreme tip only being dark brown. Muzzle and face warm brown; the hairs on the sides of the body are tipped with pale yellow with no longer or darker hairs intermixed. The whole under surface including the inside of the limbs white, fur pale grey at the base. Ears rounded and of considerable breadth, but on being laid forward they do not reach the eye. Outside of limbs coloured like the back; on the hind foot the colour extends scarcely further than the heel leaving nearly all the foot white. Foot and claw-pads very large. Tail longer than the head and body, quite rat-like. Hairs longer than the scales, but not so long as two scales, excepting towards the tip which is inclined to be pencilled. Scales $9\frac{1}{2}$ to the centimeter; $mammæ\ 2\cdot2 = 8$.

Skull of delicate proportions; the nasals project considerably beyond the line of the premaxillary; supraorbital ridge thin but very prominent, it becomes lower in the temporal region and is little more than discernable above the aural aperture: condition of occipital region unknown. The anterior palatina foramina are somewhat broad and reach the anterior margin of the molar alveoli. The anterior zygoma root is rounded above and the front edge scarcely emarginate.

Teeth.—The teeth do not call for special reference, the character of the molar pattern being sufficiently represented on the accompanying plate (fig. 1*d*).

	<i>Dimensions.</i>				Millim.
Head and body	...	...	...	...	125.0
Tail ...	...	...	...	...	148.0
Length of head	...	...	...	...	37.5
Muzzle to ear	...	...	...	...	30.0
Ear ...	...	...	...	...	17.5
Forearm and hand	...	...	...	...	35.0
Hind foot	...	...	...	...	28.0
Heel to front of last foot-pad	...	...	...	...	13.7
Last foot pad	...	...	...	...	5.0

	<i>Skull.</i>				
Greatest length	...	...	? 35.0	...	?
Basal length...	...	...	30.0	...	?
Greatest breadth	...	...	17.6	...	?
Nasals, length	...	...	14.0	...	14.5
Nasals, greatest breadth	...	...	4.0	...	4.1
Interorbital breadth	...	...	5.5	...	?
Interparietal length	...	...	4.7	...	?
Interparietal breadth	...	...	10.0	...	?
Brain-case, breadth...	...	...	13.6	...	?
Anterior zygoma root	...	...	3.5	...	3.8
Diastruma ...	...	...	9.0	...	9.8
Palate, length	...	...	18.4	...	?
Anterior palatina foramina...	...	...	5.7	...	6.0
Upper molars, length	...	...	5.7	...	6.2
Lower molars, length	...	...	6.0	...	?
Condyle to incisor tip	...	?	23.0	...	?
Coronoid tip to angle	...	...	9.2	...	?

Peale¹⁸ states that in his examples "the females have two pectoral and four abdominal teats," whereas in mine the pectorals are four. This may be reconciled by supposing that Peale overlooked a pair of mammæ, an error, as I have in a former article indicated, easily committed.

Three examples of the Funafuti native rat were included in the collection: two of these I had not the opportunity of examining. The third had the skull a little but not very seriously damaged, and fragments of a fourth specimen enabled me to add the few figures in the second column of skull dimensions.

The stomach of the rat examined contained a white vegetable substance, possibly cocoanut or pandanus.

On the Funafuti Atoll this rat is known to the inhabitants by the name of "Tikimoa."

The Pacific Ocean being bounded by the land masses of Asia, Australia, South and North America, and the genus *Mus* being exclusively confined to the Old World, it necessarily follows that this rat has entered the islands of the Pacific from an Asiatic source. This agrees with the origin of the flora of the region as sketched by Guppy,* and also with the distribution of the Lepidoptera independently remarked by Woodford.† It is thus opposed to the theory of a migration westward from America across a Mesozoic Pacific continent as advocated by Hutton.‡

POSTSCRIPT.

As previously indicated, it only needs more extensive reading to add materially to the known distribution of the Pacific rat, and already several localities may be added to those enumerated. A perusal of Brenchley, "Cruise of the Curaçoa,"^{2a} shows that it has been observed at Niue or Savage Island, situated between the Samoan and Cook Groups, and again at Aneitium, Tanna, and Efate, in the New Hebrides. It is also said to be indigenous to Upolu and Tutuila in the Samoan Islands, being at the latter place described as "the mouse." At Tongatabu the rat is said to be imported.

It may be mentioned that the only group in the South Pacific from which I have not quoted references is the Marquesas; an hiatus which would doubtless be filled did time permit to search its literature.

* Guppy—Trans. Vic. Inst., 1896. (Reprinted on p. 20 of the "General Account.")

† Woodford—Geogr. Journ., vi., 1895, pp. 349-350; also *ante*, p. 90.

‡ Hutton—Proc. Linn. Soc. N.S.W., xxi., 1896, pp. 36-47.

NATIVE RAT.

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22. Thomas, Oldfield—Pacific Rat, Proc. Zool. Soc., 1895, p. 338.
23. Turner, George—Samoa, 1884, pp. 25, 187, 216, 218.
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REPTILES.

The only turtle found in the neighbourhood of the Atoll is *Chelone mydas*, and this was regarded as by no means common. Further notice of the green turtle will be found in the introductory article (pp. 65-7), and Mr. Hedley asks me to insert the following references which he found after the preceding pages had been printed :—

As stated on p. 66, turtles were sacred animals in Polynesia, only eaten after certain ceremonies. One of the best descriptions of these we owe to Lamont,* who writes of Penrhyn Island :—

“The following day, to my surprise, we were again all marshalled and marched to the sea shore, where I found a turtle sprawling on its back. After some words were repeated over it by one of the priests who had officiated at the mara, Turua stepped forward to the edge of the water, and, in a menacing attitude, seemed to denounce someone, throwing up his arms, and vociferating at the top of his voice, as if threatening an imaginary being at sea. The turtle (or ‘hona,’ as they call it) had, it appeared, a spirit in it, which, being driven out by one of the priests, was threatened with vengeance by the bold warrior if he attempted to return. The unfortunate turtle was at once conveyed to a mara, different from the one we had visited the previous day, and after a few ceremonies was beheaded and disembowelled. A large fire was then prepared on an elevation of stones, and it was sacrificed to the gods. On our return to the gravel plot, where the people had again all assembled, a mat was placed in the centre for me, and the cooked turtle, cut into small pieces, was served up in the shell, in which it had been roasted. Monitu, Taharua, and Turua sat at a respectful distance on the mat, the rest of the people forming an extensive circle somewhat further off. My three privileged friends, diving their hands into the meat, selected the most tempting pieces, with which they endeavoured to feed me. This I rather declined, and was allowed to help myself. As they looked, at every mouthful I took, like hungry dogs, I offered one or the other a piece, which was laughingly accepted and devoured, my generosity being received with flattering comments from the circle. Extending my liberality I threw some pieces to Ocura and Mau Kakara, when, to my astonishment, the women jumped up and fled in terror, shouting ‘Huie atua!’ Taharua and Turua held my hands, and shaking their heads, gravely repeated the same words, but Monitu only laughed heartily at my mistake.”

* Lamont—Wild Life among the Pacific Islanders, 1867, p. 182.

The natives of Futuna likewise made the slaughter of a turtle an occasion of great ceremony.* By the people of Rotuma it was held in like regard.†

No sea snakes were heard of, and were apparently unknown to the islanders. The terrestrial Reptilian fauna is represented by the four Lacertilians below mentioned, which were the only members of the order included in the collection.

Mr. Hedley informs me that specimens of the geckos could at any time be secured by pulling back the pinnæ of young palms; the little creature was snugly ensconced between the base of the leaves, expanded to embrace the stem and the trunk. A search of half-a-dozen palms rarely failed to reveal one or more specimens.

The skinks afforded sport to the children, who fished for them with hook and thread among the broken undergrowth of the island: they were exceedingly numerous and could be found almost everywhere.

Mr. C. M. Woodford, in the course of some interesting remarks upon the transference, by human agency, of these reptiles from island to island, observes‡:—"It is the rule rather than the exception for one or more lizards to be unwilling passengers when one of the large native canoes is at any time put into the water. On one voyage from the Solomons to Australia I remember that a lizard frequented the foretop for several days; and on two occasions when bringing orchids to Sydney from the Solomons, I have, on opening the case, found a living gecko among the plants. They are easily brought on board ship among the firewood, and their presence, therefore, even upon remote islands, supposing that they are occasionally visited by ships, presents little difficulty."

FAMILY GECKONIDÆ.

GYMNODACTYLUS, *Spix.*

GYMNODACTYLUS PELAGICUS, *Girard.*

Gymnodactylus pelagicus, Girard, sp., Proc. Acad. Nat. Sci. Phil., 1857, p. 197; Günther, Voy. "Curaçoa," p. 404, pl. xxiv., fig. a.

This species, so widely distributed in the islands of the Pacific, is represented by specimens which differ slightly from the descriptions of the species. The dorsal tubercles are not so closely set as shown in Günther's figure, but are separated by two or three

* Smith—Journ. Polyn. Soc., i., 1892, p. 41.

† Allardye, G. W. L.—Proc. and Trans. R. Geogr. Soc. Austr., Qd., i., 1886, p. 142.

‡ Woodford—Geogr. Journ., vi., 1895, p. 349.

tubercles. Those on the hind limb are arranged in rows almost as regular as those of the back. The specimens do not exhibit tubercles on the tail as found in some examples, and as the markings are similar to those on the body it does not appear that the member has been reproduced.

GEHYRA, *Gray*.

GEHYRA OCEANICA, *Lesson*.

Gehyra oceanica, Lesson, sp., Voy. "Coquille," Zool., ii., p. 42, pl. ii., fig. 3.

The specimens collected do not in any way differ from those obtained in the other Polynesian Islands, throughout which the species is widely distributed.

FAMILY SCINCIDÆ.

LYGOSOMA (EMOA), *Gray*.

LYGOSOMA CYANURUM, *Lesson*.

Lygosoma cyanurum, Lesson, sp., Voy. "Coquille," Zool., ii., p. 49, pl. iv., fig. 2.

The phrase* "four labials anterior to the large subocular" should read "four or five labials," etc., in order to receive the examples from Funafuti which do not otherwise differ from specimens received from elsewhere.

LYGOSOMA ADSPERSUM, *Steindachner*.

Lygosoma adpersum, Steindachner, sp., Sitz. K. Akad. Wiss. Wien., lxii., 1870, pl. iv., fig. 1.

This species, apparently the least widely known of the four Lacertilians received, is very common on the Funafuti Atoll. Eggs were obtained; they are very nearly spherical, their greatest diameter measuring 13 millim., and their least diameter 12 millim.

Finsch has recorded† four Lacertilians from the Gilbert Group, two of which only are identical with ours. He enumerates the following:—*Gehyra oceanica*, *Platydactylus* (*Lepidodactylus*) *lugubris*, *Mabouia* (*Lygosoma*) *cyanura*, and *Ablepharus pœcilo-pleurus* (*A. boutonii*).

* Brit. Mus. Cat. Lizards, iii., 1887, p. 290.

† Ann. K.K. Naturhist. Hofmus., viii., 1893, p. 21.

FISHES.

The Collection of Fishes comprises fifty-four species, which are for the most part well known forms. A large number of them are widely distributed, and range from the Red Sea and the east coast of Africa across the Indian and Java Seas to Polynesia. Smaller and possibly more interesting species were not obtained, due to the only possible method of procuring them. The natives brought in the fishes as caught by net or hook, and not conceiving that they were required for other than edible purposes, naturally preserved only the best examples from their point of view. At first they very sedulously avoided bringing to land any specimens they regarded as poisonous, and it was some time before they could be made to understand that the fishes were not to be eaten.

Zoologically this notice is little more than a list, which is of value more especially for extending the known range, and by supplying an exact locality for the species enumerated.

Some of the short notes may be of wider interest, and this refers especially to the native names which have an Ethnological value.

All the specimens have been referred to described species, but in a few instances the identification is doubtful, due to insufficient descriptions, the fugitive nature of the characters described, or to the necessary literature not being accessible.

SERRANIDÆ.

EPINEPHELUS, *Bloch.*EPINEPHELUS URODELUS, *Cuv. & Val.*

Epinephelus urodelus, Cuv. & Val., sp., Hist. Nat., ii., p. 306 ;
Günther, Fische der Südsee, p. 3, pl. iii., fig. *a*.

This brilliantly coloured "rock-cod" is called "Matiri" by the natives, and the only example obtained is of the variety with the white convergent lines on the tail.

EPINEPHELUS LEOPARDUS, *Lacépède.*

Epinephelus leopardus Lacépède, sp., Poiss., iii., p. 517, pl. xxx.,
fig. 1 ; Günther, Fische der Südsee, p. 4, pl. iii., fig. *b*.

Although many of the Serranidæ are nearly allied, I have no doubt that the only specimen available is correctly assigned to the present species. In addition to its comparative proportions it agrees well with Günther's figure, the black band on the upper lobe of the tail is however alone developed.

EPINEPHELUS TAUVINA, Forsk.

Epinephelus tauvina, Forsk., sp., Descr. Anim., p. 39 ; Bleeker, Atlas Ichth., pl. cclxxxiii., fig. 1.

Greatly esteemed as food on the island and fished for with hook and line, both within the lagoon and from the outer reefs. In the absence of a good series (having only one example) I cannot be certain of the identification, its characters, however, agree most nearly with the descriptions of this widely distributed Indo-Pacific species. It is evidently a young fish, measuring only 272 millim.

The native name is "Mou."

EPINEPHELUS MERRA, Bloch.

Epinephelus merra, Bloch., Ausl. Fische, vii., p. 17, pl. cccxxix. ; Günther, Fische der Südsee, p. 7, pl. vii.

One example of the typical form, namely no white spots on the body, and the pectorals with round black spots. This species so far as could be ascertained did not frequent the lagoon, at least it was not caught there, but Mr. Hedley hooked some off the outer reef, where they entered the crevasses and took the bait greedily. The natives, it appears, at the time of the Expedition, only fished the lagoon, all species from the reefs being indiscriminately condemned.

Quantities of pumice were recently washed on to the beach, and several of the inhabitants became ill and one died after eating fish caught from the reefs. As this was supposed to be in consequence of the presence of the pumice, the fish were condemned, but will again be utilised when the pumice ceases to be thrown up. This ban did not refer to fishes caught in the lagoon, which was free from pumice.

As pumice is a harmless substance, Mr. Hedley suggests that its occurrence was coincident with the arrival of some marine organism, which might vitiate the food supply of the fish, and thus indirectly have a harmful effect upon the natives.

In this connection Wyatt Gill writes* :—"On the outer edge of our coral reefs exists a sea-centipede (*Nereis*), in appearance like a black thread slowly moving amongst the rugged submarine growths. The *ae* attains the length of five or six feet. Good fish become poisonous through feeding on these sea-centipedes.

"Strangely enough, fish that are excellent eating on one island may be poisonous on another. Thus the dainty *matakiva* of Mangaia is poisonous on the neighbouring island of Mitiaro. A chief of that atoll, hearing that it is much prized in Mangaia,

* Gill—Life in the Southern Isles, 1876, p. 274.

concluded it was a mere fancy of his countrymen that it should be hurtful at Mitiaro. Accordingly, he ate one, and died a few hours afterwards."

The native name of this species is "Natala," and the size of the specimen preserved 198 millim.

LUTIANUS, *Bloch.*

LUTIANUS BENGALENSIS, *Bloch.*

Lutianus bengalensis, Bloch., sp., Fisch., pl. ccxlv., fig. 2, Bl. Schn., p. 316; Temm. & Schleg., Fauna Japon. Poiss., pl. vi., fig. 2.

Attaining a length of ten inches this fish is a valuable source of food supply, and two names were obtained for it, namely "Savani" and "Tumti." After the large depopulation of the island of Funafuti by American slave traders, immigrants arrived from adjacent shores. Mr. Hedley therefore supposes that one of these names was imported from some neighbouring tribe.

A very young example of only 38 millim., and without doubt of this species, is, as is common with young forms, much more spiniferous than the adult. The preopercle is strongly denticulated, and is produced into a strong spine at the angle.

LUTIANUS GIBBUS, *Forsk.*

Lutianus gibbus, Forsk., sp., Descr. Anim., p. 46; Günther, Fische der Südsee, p. 12, pl. xii.

The native name "Teia" is identical with that recorded by Günther "Taea," as in use in the Society Islands. The specimen which has attained its adult colouration measures 270 millim.

LUTIANUS FULVIFLAMMA, *Forsk.*

Lutianus fulviflamma, Forsk., sp., Descr. Anim., p. 45; Bleeker, Atlas Ichth., pl. ccc., fig. 2.

The only specimen received serves to extend the known range of the species.

CHÆTODONTIDÆ.

CHÆTODON, *Cuvier.*

CHÆTODON AURIGA, *Forsk.*

Chaetodon auriga, Forsk., Descr. Anim., p. 60; Günther, Fische der Südsee, p. 36, pl. xxvi., fig. b.

Although the island of Funafuti should be a veritable home for Chætodons, Chelmos, Holacanth, etc., many of which were seen swimming in the crevasses, this is the only member of the

family obtained. As previously mentioned this is to be accounted for by the fact that only the larger species were, as a rule, collected by the natives. This *Chaetodon* is of the variety *setifer*, and measures 114 millim. in length.

MULLIDÆ.

MULLOIDES, *Bleeker*.

9. MULLOIDES FLAVOLINEATUS, *Lacépède*.

Mulloides flavolineatus, Lacépède, sp., Poiss., iii., p. 406; Rüppell, N.W. Fische, p. 101, pl. xxvi., fig. 1.

This species is represented by a single example.

The Funafuti name is "Malili."

MULLOIDES SAMOENSIS, *Günther*.

Mulloides samoensis, Günther, Fische der Südsee, p. 57, pl. xliii., fig. b.

(Pl. viii., fig. 2 a-b.)

I have referred to this species a small specimen which measures only 76 millim. in total length, or less than half the dimensions of the type specimen: "6½ Zoll" (= 165 millim.). As the species was founded on a single example, and as it does not appear to have been met with since first described (1873), the following description will assist in verifying or disproving the determination:—

D. vii., I 8. V. I 5. A. II 6. L lat. 40 L tr 2½, 6.

Length of head 3·4, of caudal fin 5·0, height of body 4·2 in the length of the body (exclusive of the caudal fin). Diameter of eye 3·6, length of snout 2·4 in length of head; interorbital space very lowly arched 4·0 in length of head. Upper jaw the longer. The maxilla reaches two-thirds the distance to below the anterior edge of the orbit.

The barbels extend to slightly beyond the posterior edge of the preopercle. Upper profile from above the eye to the snout markedly convex. Opercle with a weak spine and a slight denticulation, indicative of a second spine above. Teeth in villiform bands in both jaws. First and second dorsal spines of equal length, 1·7 in the length of the head. Second dorsal two-thirds the height of the first. The anal commences slightly behind the second dorsal. The ventrals do not reach the vent by fully a third of their length; caudal deeply forked, the least height of its pedicle equals the intradorsal space.

Scales ctenoid, in five series between the dorsal fins. Tubes of the lateral line not much branched, consisting of two main arms

bifurcated anteriorly, but simple from below the second dorsal to the caudal.

Colours.—In formol, silvery white with a greenish tinge on the dorsal surface: the top of the head is yellowish, and the same colour is to be traced on the cheeks—there is a distinct yellow spot immediately above the opercular spine. Fins immaculate, excepting the caudal which, towards the base, is of yellowish hue. The black and pearl-coloured blotches mentioned by Günther are not to be observed in our example. The type specimen was obtained at Apia in the Samoa Islands, one of the archipelagos nearest to the Ellice Group.

UPENEUS, *Bleeker*.

UPENEUS TRIFASCIATUS, *Lacépède*.

Upeneus trifasciatus, Lacépède, sp., Poiss., iii., p. 104, pl. 15, fig. 1; Günther, *Fische der Südsee*, p. 59, pl. xlv., figs. b, c.

This widely distributed form is represented by a solitary example, in which the usual dark markings are almost obsolete, the body band beneath the second dorsal is the most pronounced, whilst the black mark on the basal half of this fin is the darkest feature of the specimen. It measures 173 millim.

The native name is "Teforo."

SPARIDÆ.

LETHRINUS, *Cuvier*.

LETHRINUS ROSTRATUS, *Cuv. & Val.*

Lethrinus rostratus, Cuv. & Val., sp., *Hist. Nat.*, vi., p. 296; Playfair, *Fishes of Zanzibar*, p. 44, pl. vii., fig. 2.

Said to be common and a favorite food-fish. When the more esteemed species are not caught in sufficient numbers, inferior kinds are eaten in consequence of the limited flesh-foods on the island. A small example only was brought to Sydney.

Known to the natives as "Nutta."

LETHRINUS RAMAK, *Forsk.*

Lathrinus ramak, Forsk., sp., *Descr. Anim.*, p. 52; Günther, *Fische der Südsee*, p. 64, pl. xlv., fig. 13.

The two yellow longitudinal bands which Günther remarks are such a striking feature in the living fish, are very conspicuous in two of our three examples. There is also a third fainter and

narrower band immediately below the lateral line, this is indicated in Günther's figure but is not referred to in the text. These specimens appear to be rather larger than any previously recorded, measuring 315, 307 and 287 millim. respectively.

The native name is "Gropa."

SPHÆRODON, *Rüppell*.

SPHÆRODON GRANDOCULIS, *Forsk.*

Sphærodon grandoculis, *Forsk.*, sp., *Descr. Anim.*, p. 53; *Bleeker*, *Atlas Ichth.*, pl. cxcix., fig. 1.

Found widely distributed in the South Seas, and extending across the Indian Ocean to the Red Sea, this species is now recorded from the Ellice Group. The example examined totals a length of 312 millim. The figure referred to represents a young individual showing the white transverse body bands.

CIRRHITIDÆ.

CIRRHITES, *Cuvier*.

CIRRHITES MACULATUS, *Lacépède*.

Cirrhitès maculatus, *Lacépède*, *Poiss.*, sp., v., p. 3; *Günther*, *Fische der Südsee*, p. 71, pl. li., fig. a.

Readily distinguishable, in conjunction with other characters, by the smallness of the scales on the cheeks, the species is represented by two individuals, measuring 200 and 164 millim. respectively. This record is interesting, as the species does not appear to have been obtained from many of the Pacific Islands.

BERYCIDÆ.

HOLOCENTRUM, *Artedi*.

HOLOCENTRUM ERYTHRÆUM, *Günther*.

Holocentrum erythræum, *Günther*, sp., *Cat. of Fishes*, i., p. 32; *Fische der Südsee*, p. 99, pl. lxiii., fig. b.

The occurrence of this species in the Ellice Group adds one more definite locality to its known distribution. It has a wide range in the Southern Seas, but was not regarded as common in Funafuti, where it is known as "Malou." The single specimen obtained measures 200 millim. in total length.

HOLOCENTRUM DIPLOXIPHUS, *Günther*.

Holocentrum diploxiphus, Günther, Proc. Zool. Soc., 1871, p. 660, pl. lx.

This species is also known from several of the Polynesian Islands, and as Günther remarks, apparently remains of small size: the only example brought home measures 144 millim. in length.

It is called "Boutularu" on the island of Funafuti.

* TEUTHIDÆ.

TEUTHIS, *Linncæus*.

TEUTHIS ROSTRATA, *Cuv. & Val.*

Teuthis rostrata, Cuv. & Val., Hist. Nat., x., p. 158; Playfair, Fishes of Zanzibar, p. 50, pl. x., fig. 2.

As the descriptions of the various species are for the most part little more than a notice of the colour-pattern, and as this usually fades on contact with spirit, the determination of the species cannot be satisfactory without a good series of the genus. Our two examples I determine as *Teuthis rostratus*, and a comparison with Playfair's description and figure largely removes any doubt as to their identity. Günther has identified the species from the Society, Pelew, and Gilbert Islands, so that its occurrence in Funafuti is merely an extension of the known range.

Known to the natives as "Mai'ava" or "Meia."

ACRONURIDÆ.

ACANTHURUS, *Bloch*.

ACANTHURUS TRIOSTEGUS, *Linn*.

Acanthurus triostegus, Linn., Syst. Nat., i., p. 463; Bennett, Fishes of Ceylon, p. 11., pl. xi.

One would scarcely expect to receive even a very small collection of fishes from the Pacific Islands without this ubiquitous species being included. Of three examples the largest measures 158, the smallest 54 millim.

The native name in Funafuti is "Manini," and its universal application is noteworthy. Günther remarks:—"Throughout the whole of Polynesia it is called 'Manini.'"

* For paper on the Teuthidoidea, see Gill, Proc. U.S. Nat. Mus., vii., 1885, p. 276.

ACANTHURUS GUTTATUS, Forsk.

Acanthurus guttatus, Forsk., sp., Descr. Anim., p. 218; Günther, Fische der Südsee, p. 109, pl. lxix., fig. a.

This species has also a wide range in the Pacific. We have two specimens from the atoll, measuring 208 and 190 millim respectively.

The native name is rendered as "Te api" or "Yappi," which is practically identical with "Hapi" in use in the Sandwich Islands, as recorded by Günther.

ACANTHURUS BLOCHII, Cuv. & Val.

Acanthurus blochii, Cuv. & Val., Hist. Nat., x., p. 209 (*fide* Günther); Günther, Fische der Südsee, p. 109, pl. lxix., fig. b.

Günther remarks that it is extremely doubtful whether *A. matoides*, Klunz., from the Red Sea, is identical with the species he had hitherto so named. He therefore adopts the name *A. blochii*, which species is to be distinguished by the dorsal fin being lower in proportion to the height of the body. Our specimens quite agree in this respect, for the spines are $3\frac{1}{3}$, whereas in Klunzinger's species they are much longer, namely $2\frac{3}{4}$ in the height of the body.

ACANTHURUS ACHILLES, Shaw.

Acanthurus achilles, Shaw, Zool., iv., p. 383; Günther, Fische der Südsee, p. 115, pl. lxxi., fig. b.

Several examples of this unmistakable and handsome species were brought from Funafuti, where they are known to the inhabitants as "Matto."

*NASEUS, Commer.**NASEUS LITURATUS, Forsk.*

Naseus lituratus, Forsk., sp., Descr. Anim., p. 218; Günther, Fische der Südsee, p. 124, pl. lxxxii.

The natives appear to have associated this genus with the Aconuridae, for while *A. triostegus* is designated as "Manini," the present species is distinguished by a prefix, the rendering being "Rakomanini."

CARANGIDÆ.

CARANX *Lacépède.*CARANX MUROADSI, *Temm. & Schleg.*

Caranx muroadsi, Temm. & Schleg., Fauna Japon. Poiss., p. 108, pl. lviii, fig. 1.

While I cannot be absolutely certain of the correct determination of the species, the aggregate characters lead me to name the only specimen procured as above. *Caranx muroadsi* has not, so far as I am aware, been previously recorded from other than the seas of Japan, with Ternate doubtful. (Günther.) Length of specimen 295 millim.

CARANX CRUMENOPHTHALMUS, *Bloch.*

Caranx crumenophthalmus, Bloch., sp., Fisch., pl. cccxliii. ; Jenyns, Voy. of "Beagle," Fish, p. 69, pl. xv.

This widely distributed form is represented by two small specimens of equal size (210 millim.). Together with other small material they were preserved in a 5% solution of formol, which has several advantages over spirits. No appreciable shrinkage takes place, and the flesh remains quite firm, while delicate forms such as *Leptocephalus*, and minute membranous structures, as for example the adipose fin of small scopelids, are perfectly preserved. As a colour preservative it is incomparable with spirit, which, as is only too well known, renders nearly all specimens of the same uniform yellowish-brown. The action of formol is beneficial in yet another way. Fishes killed in this fluid die with their members extended, so that the fin formulæ of the smallest forms (*Gobius*, *Salarias*) can be counted with delightful ease and without disturbing a single ray. Lastly, spirit cannot be diluted to more than half its bulk, while formol may be carried at one-twentieth the bulk at which it can be used, a matter of no small consideration to a heavily equipped collector.

CHORINEMUS, *Cuv. & Val.*CHORINEMUS SANCTI-PETRI, *Cuv. & Val.*

Chorinemus sancti-petri, Cuv. & Val., Hist. Nat., viii., p. 379, pl. ccxxxvi.

In Day's "Fishes of India," (p. 230) there is a misprint, by which the second dorsal is made to commence "midway between the snout and the front nostril." In the "Fauna of British India," (p. 174) the passage is simply omitted. It was probably intended to read: "midway between the snout and the front (base) of the caudal."

Another palpable error occurs in the measurement of the pectoral, and as this is copied into the "Fauna," (*loc. cit.*) it may be further mentioned. The length of this fin is stated to be " $4\frac{1}{2}$ in the total length." In the Funafuti example (525 millim. to middle caudal rays) it is contained 7·8 times, or 9 times in the extreme length, which was probably the measurement taken by Day.

TRACHYNOTUS, *Cuv. & Val.*

TRACHYNOTUS BAILLONII, *Lacépède.*

Trachynotus baillonii, Lacépède, sp., Poiss., iii., p. 93, pl. iii., fig. 1.

Represented only by a very young example measuring 85 millim. in length.

SCOMBRIDÆ.

ECHENEIS, *Artedi.*

ECHENEIS NAUCRATES, *Linn.*

Echeneis naucrates, Linn., Syst. Nat., i., p. 446 ; Temm. & Schleg., Fauna Japon. Poiss., p. 270, pl. cxx., fig. 1.

578 millim. is the length of the only "sucker-fish" collected.

GOBIIDÆ.

GObIUS, *Artedi.*

GObIUS BIOCELLATUS, *Cuv. & Val.*

Gobius biocellatus, Cuv. & Val., Hist. Nat., xii., p. 73 ; Day, Fishes of India, pl. lxiii., fig. 8.

To this species I have doubtfully referred a small specimen of 38 millim., but it is too young for certain determination.

BLENNIIDÆ.

SALARIAS, *Cuv.*

SALARIAS MARMORATUS, *Bennett.*

Salarias marmoratus, Bennett, sp., Zool. Journ., iv., p. 35 ; Günther, Fische der Südsee, p. 204, pl. cxvi., fig. b.

A nice series of this beautiful species was obtained (largest specimen 72 millim.). Günther's figure gives an excellent representation of the fish ; it may be remarked that the markings at the base of the second dorsal are in reality oblique lines directed

backwards and not isolated spots as shown. The white spots on the head-parts, present only in some examples, are raised tubercles. Each supra-orbital tentacle consists of a median tapering stem, whence arises a number of lateral filaments, which are larger and more numerous on the inner side. The nasal tentacles each comprise a short stalk and a palm-like portion terminating in 7-9 digitations. The occipital tentacles are simple. The short streak behind the eye, which Günther remarks is characteristic of the species is, in formol-preserved examples, of a deep blue colour.

SALARIAS QUADRICORNIS, Cuv. & Val.

Salarias quadricornis, Cuv. & Val., Hist. Nat., xi., p. 329, pl. cccxxix.; Günther, Fische der Südsee, p. 209, pl. cxvii., fig. b.

The collection contains several examples, all small, however, as the largest one measures only 77 millim. This species was exceedingly common, swarming in every rock pool, as indeed one might imagine by the fact of the natives having designated ("Monaco") a fish not edible nor otherwise useful. When removed from the pools it skipped over the rocks in such a manner as to induce the belief that it was a *Periophthalmus*.

MUGILIDÆ.

MYXUS, Günther.

MYXUS LEUCISCUS, Günther.

Myxus leuciscus, Günther, Proc. Zool. Soc., 1871, p. 666, pl. lxxv., fig. a; Fische der Südsee, p. 220, pl. cxxi., fig. c.

The only grey mullet collected is assigned to this species. In the "Fische der Südsee" the length of the head is misprinted as $\frac{3}{4}$ of the total length. It should read $\frac{1}{4}$, as in the original description.

The native name is "Foua."

GLYPHIDODONTIDÆ.

TETRADRACHMUM, Cantor.

TETRADRACHMUM ARUANUM, Bloch.

Tetradrachmum aruanum, Bloch., sp., Fisch., iii., p. 62, pl. cxcviii., fig. 2; Bennett, Fishes of Ceylon, p. 17, pl. xvii.

Represented by one small specimen of only 32 millim. in length. Common throughout the South Seas.

GLYPHIDODON, *Cuvier*.GLYPHIDODON BROWNRIGGII, *Bennett*.

Glyphidodon brownriggii, Bennett, Fishes of Ceylon, p. 8, pl. viii.;
Günther, Fische der Südsee, p. 232, pl. cxxvii. (varieties).

A number of specimens was collected representing five varieties, some of which have been specifically named, they are as follows:—

(1) The original form figured by Bennett. (Fishes of Ceylon, pl. viii.)

(2) Coloration uniform. (*G. modestus*, Bleeker, Atlas Ichth., pl. cccci., fig. 9.)

(3) An oblique white band on the body, a dark spot on the spinous dorsal, and a smaller one at the posterior base of the soft dorsal.

(4) Same as No. 3 but without the white body-band.

(5) An oblique white band on the body, a dark one across the base of the caudal. A dark spot on the spinous dorsal, and the whole base of the soft dorsal dark. Anal wholly dark coloured.

GLYPHIDODON SORDIDUS, *Forsk.*

Glyphidodon sordidus, Forsk., Descr. Anim., p. 62; Bleeker, Atlas Ichth., pl. ccccx., fig. 5.

Three very young examples are credited to this species. In addition to the large black spot on the upper surface of the caudal pedicle, there is a small one at the base of the pectoral, and a large black mark on the dorsal extending from the second to the sixth spine; as the transverse bands become fainter, so this mark apparently disappears in adult examples: it is noticeably more pronounced in our smallest specimen (18 millim.), which is little more than a third the length of the largest (48 millim.).

GLYPHIDODON SEPTEM-FASCIATUS, *Cuv. & Val.*

Glyphidodon septem-fasciatus, Cuv. & Val., Hist. Nat., v., p. 463; Bleeker, Atlas Ichth., pl. cccix., fig. 5.

One specimen, half-grown. Attaining larger dimensions than some other members of the genus, this species has received a native name, being known to the inhabitants as "Moutou moutou."

LABRIDÆ.

CHILINUS, *Cuvier*.CHILINUS TRILOBATUS, *Lacépède*.

Chilinus trilobatus, Lacépède, Poiss., iii., pp. 529, 537, pl. xxxi., fig. 3; Bleeker, Atlas Ichth., p. 66, pl. xxvii., fig. 2.

One example, a widely distributed species in the South Seas, attains a length of two feet.

CHILINUS FASCIATUS, *Bloch.*

Chilinus fasciatus, Bloch., Fisch, v., p. 18, pl. cclvii.; Günther, Fische der Südsee, p. 246, pl. cxxxiv.

A smaller species, but equally well known. Two specimens were collected under the native name, "Moree."

JULIS, *Cuv. & Val.*JULIS LUNARIS, *Linn.*

Julis lunaris, Linn., Syst. Nat., i., p. 474; Bleeker, Atlas Ichth., p. 90, pl. xxxiii., fig. 5.

One of the commonest fishes of the Indo-Pacific. Name given by the Funafuti islanders, "Lapi."

PSEUDOSCARUS, *Bleeker.*

Four species of *Pseudoscarus* are included in the Collection, and these have been determined as follows:—It is, however, necessary to mention that the identification is by no means satisfactory, as there are such a large number of species (valid or otherwise) named rather than described. "The *Pseudoscarus* are beautifully coloured, but the colours change with age, and vary in an extraordinary degree in the same species. They fade rapidly after death, so that it is almost impossible to recognise in preserved specimens the species described from living individuals."*

Unfortunately none of these fishes were placed in formol, or judging by results obtained in the case of other Labroids caught near Sydney, and so preserved, much of the colour might have been retained.

These individuals, so much alike in our hands, must when alive exhibit great variety of colour and pattern as delineated by Bleeker, for the Funafuti natives recognise and name the several species.

PSEUDOSCARUS PULCHELLUS, *Rüppell.*

Pseudoscarus pulchellus, Rüppell, sp., N.W. Fische, p. 25, pl. viii., fig. 3; Bleeker, Atlas Ichth., pl. x., fig. 3.

Previously recorded from the Red Sea, Mauritius, Java, Celebes, China.?

Funafuti native name, "Oulafi" or "Ourafi."

* Günther—Study of Fishes, p. 532.

PSEUDOSCARUS BATAVIENSIS, Bleeker.

Pseudoscarns bataviensis, Bleeker, sp., Java, iv., p. 342 ; Atlas, Ichth., pl. xii., fig. 3.

Previously recorded from Batavia.

Funafuti native name, "Samaria."

PSEUDOSCARUS SINGAPURENSIS, Bleeker.

Pseudoscarus singapurensis, Bleeker, sp., Singapore, p. 69 ; Atlas, Ichth., pl. xiii., fig. 1.

Previously recorded from Singapore and Java.

Funafuti native name, "Ruggea."

PSEUDOSCARUS TROSCHELLI, Bleeker.

Pseudoscarus troschelli, Bleeker, sp., Batavia, p. 498 ; Atlas, Ichth., pl. vii., fig. 2.

Previously recorded from Java.

Funafuti native name, "Soumoulaia."

OPHIDIIDÆ.

*FIERASFER, Cuvier.**FIERASFER HOMII, Richardson.*

Fierasfer homii, Richardson, sp., Voy. Ereb. and Terr. Fishes, p. 74, pl. xxxiv., figs. 7-18.

Mr. Hedley obtained a large Holothurian (*H. argus*, Semper,) two feet in length. After it had been in a bucket for half-an-hour, the *Fierasfer* swam out and was bottled in formol. These parasitic Ophidiidæ, as is well known, inhabit the breathing cavities of various invertebrates ; they are said to be quite harmless, though possibly inconvenient to their host.

The specimen does not differ from that described by Richardson, and measures 104 millim. in length.

SCOMBRESOCIDÆ.

*BELONE, Cuvier.**BELONE PLATURA, Bennett.*

Belone platura, Bennett, Proc. Zool. Soc., 1830, p. 168 ; Rüppell, N.W. Fische, p. 73, pl. xx., fig. 1.

Although I have named the single *Belone* obtained, as above, I cannot be certain of the determination. Its characters, however, on the whole ally it with this species.

Native name, "Kashufi."

HEMIRHAMPHUS, *Cuvier*.HEMIRHAMPHUS BALINENSIS, *Bleeker*.

Hemirhamphus balinensis, Bleeker, Nat. Tydschr. Ned. Ind., xvii., p. 170.

I was at first inclined to regard this "half-beak" as *H. intermedius*. It agrees more nearly with Bleeker's species, and as Cantor has decided that they are specifically distinct, I have no alternative but to name our single example as above. It is not in good condition, and therefore not suitable for purposes of re-description. In company with Flying Fish, the Hemirhamphi were attracted to the canoes at night by means of flaming palm brands, and were secured in hoop nets within the lagoon.

MURÆNIDÆ.

OPHICHTHYS, *Ahl.*OPHICHTHYS COLUBRINUS, *Boddaert*.

(Pl. viii., fig. 3.)

Ophichthys colubrinus, Boddaert, Neue Nord. Beytr. (Pallas's), ii., 1781, p. 56, pl. ii., fig. 3 ; Quoy & Gaim., Voy. Uran., I., p. 243, pl. xlv., fig. 2.

The three examples obtained agree in having the transverse bands widely interrupted beneath, so that in reality they are only half-bands adorning the dorsal surface. In some examples the bands are nearly as wide as the interspaces, in ours they are very narrow, being but one-sixth the width of the interspaces. There is no dark spot between the bands as found in some specimens, and figured by Quoy and Gaimard.

Wyatt Gill* describes how eels live in holes in the coral and attain formidable dimensions ; he also gives a very recognisable illustration of a typical example of this species.

The native name is "Boureriva."

MURÆNA, *Artedi*.MURÆNA FORMOSA, *Bleeker*.

Muraena formosa, Bleeker, Ned. Tydschr. Dierk., ii., p. 51 ; Atlas Ichth., p. 94, pl. clxxiv., fig. 1.

In its general form and proportions, the single specimen secured, approaches most nearly to this species, but of its absolute identity I cannot be certain. The colouration and general pattern agree well with Bleeker's figure of the adult, and our example exhibits the black spot at the angle of the mouth, and the dark blotch on

* Gill—Life in the Southern Isles, 1876, p. 279.

the gill-opening, which are stated to be of value in determining the species. Two examples in the British Museum are from Ceram and Amboyna respectively.

At Funafuti this eel is called "Foussi" or "Poussi."

MURÆNA BUROËNSIS, *Bleeker*.

Muræna buroënsis, Bleeker, Nat. Tydschr. Ned. Ind., xiii., p. 79; Atlas Ichth., p. 105, pl. clxxv., fig. 2.

A smaller eel is with some hesitancy assigned to this species; while its general characteristics agree with the description, the colour is slightly different. As, however, the colouration in the Murænidæ varies much according to age or other conditions, it is not of such specific value as has unfortunately been relied upon to determine the many described species. Our example, preserved in spirits, is of a greenish-brown colour, the dorsal surface including the fin and the sides from head to tail closely punctated with black, none of the dots being as large as a pin's head.

The ventral surface especially anteriorly is immaculate, posteriorly the spots descend, and the last inch or so of the tail, including the surrounding fin, is dotted like the upper surface.

It would appear that the Funafuti native name for an eel is "Poussi" ("Foussi"), this species being distinguished as "Poussikenna." Eels were so exceedingly numerous among the reefs round the island, that the native boys used to secure them by beating them with a palm leaf stem as they swam in the water. The three species were obtained in this manner. Eels were also caught in the rock pools by means of hoop nets.

BALISTIDÆ.

BALISTES, *Artedi*.

BALISTES FUSCUS, *Bloch*.

Balistes fuscus, Bloch, Schn., p. 471; Bleeker, Atlas Ichth., p. 111, pl. ccxxv., fig. 3.

Two adult examples, wherein the caudal lobes are greatly produced and the anterior portions of the dorsal and anal fins much elevated, even more than in Bleeker's figure. The amount of development, which both these fins and the caudal undergoes as the fish attains maturity, will be well seen by comparing this figure with that of Day's,* which represents a young example of the natural size. Rüppell† has illustrated the species of intermediate age.

Funafuti native name, "Oom."

* Day—Fishes of India, pl. clxxviii., fig. 4.

† Rüppell—Atlas, pl. vii., fig. 2.

BALISTES FLAVOMARGINATUS, Rüpp.

Balistes flavomarginatus, Rüpp., Atlas Fische, p. 33; Bleeker, Atlas Ichth., pl. cccxiv., fig. 3.

One specimen secured. It agrees exactly with the figure cited, both as to size and proportions, but the representation is spoilt by the delineation of the scales on the snout, which as Günther remarks are not correctly drawn.

BALISTES ACULEATUS, Linn.

Balistes aculeatus, Linn., Syst. Nat., i., p. 406; Bleeker, Atlas Ichth., pl. ccxvi., fig. 3.

Under the name of "Soumou," one example of this beautiful and very widely distributed species is in the Funafuti Collection, and is apparently as common in the Ellice Group as in other islands of the Pacific.

DIODONTIDÆ.

TETRODON, Linnæus.

TETRODON NIGROPUNCTATUS, Bloch.

Tetrodon nigropunctatus, Bloch, Schn., p. 507; Bleeker, Atlas Ichth., pl. ccvi., fig. 4.

The Collection includes two adult examples, both of which when alive exhibited a beautiful lemon colour on the entire ventral surface, thus approaching the variety *citrinella*. One of the two specimens is very spiny, and the other is in part almost naked. Although it is known that some Diodons are able to erect their spines independently of the inflation of the body, personally I had no idea that Tetrodons could accomplish a similar result to such an extent as is exhibited by our specimens. Examining the two side by side one was seen to be exceedingly spiny, while the other as indicated appeared to be devoid of such armaments; it was not until the last named example was turned over that I realised they were of the same species. The right side of this specimen has the spines fully protruded, while on the left side they are deeply imbedded, but can be readily found and protruded by means of a knife or other instrument. A Tetrodon killed with its spines erected may present a very different appearance to one of the same species killed while the spines were imbedded beneath the skin. As the spiniferous character is used in describing or determining the various species, it has been thought advisable to indicate that it may not be so constant as has been imagined.

I find that Günther has drawn attention to the fact that this species varies in its spiny character, but was apparently unaware

that an individual might exhibit each variation as circumstances altered. He writes as follows* :—

"This species varies in a remarkable manner in the extent of the spines over the body : sometimes they project much out of the skin, and cover nearly the entire body like bristles : sometimes they are much less numerous, and nearly entirely hidden in the skin, the greater part of which appears to be smooth."

Tetrodon nigropunctatus is included in a division characterised by the presence on each side of the snout of "two solid nasal tentacles without opening." Of this species I would rather say that there is a single tentacle on each side of the snout, each tentacle consisting of a stalk separated at about half its height into two lobes. On examining these lobes with a lens they were seen to be distinctly porous at the apex, and suspecting the presence of a canal one of the tentacles was removed, when two depressions were observable in the pedicle, each depression corresponding with one of the lobes. On cutting sections, the microscope revealed the presence of two black spots which may have been the pigmental and juxtaposed walls of two canals. The tentacles had however been so shrivelled, that nothing more satisfactory could be made out.

The native name of the species, which is very common around the Atoll, is "Soui."

TETRODON IMMACULATUS, Bloch.

Tetrodon immaculatus, Bloch., Schn., p. 507 ; Bleeker, Atlas Ichth., p. 75, pl. cxxi., fig. 1.

One half-grown example is included in the Collection. The stomachs of all these *Tetrodons* were crowded with coral, which grated together when the body was touched. In *T. nigropunctatus* the coral consisted of the finer branchlets of a *Pocillopora*, found growing in the shallower water where the *Tetrodons* were obtained. Some of the pieces swallowed, measured nearly $\frac{3}{4}$ inch in length, and were much branched.

The food of *T. immaculatus*, as exhibited by our specimen, was composed of pieces of the stock of a coral unbranched, and not exceeding a pea in size. With these were associated some Foraminifera, which my colleague, Mr. Thomas Whitelegge, has identified as *Orbitolites complanata* and *Tinoporus baculatus*.

Darwin has noticed two species of *Scarus* as browsing upon corals.†

* Günther—Cat. of Fishes, viii., p. 293.

† Darwin—Coral Reefs, 1874, p. 19.

The fifty-four species here enumerated are those brought to Sydney, but this number does not exhaust even the common fishes of the Atoll, many different kinds not obtained were observed swimming about the coral growth, or in the deep water beyond. Other species were obtained, but for various reasons were not preserved. We are told (page 65) how a giant ray (probably *Ceratoptera*) was harpooned in shoal water in the Lagoon, and the large fins cut off to make a meal for the families of its captors. It is also mentioned that the "Bonito" (*Thynnus*), is attracted and caught with pearl-shell hooks trailed unbaited over the surface, their gleaming nacre being a sufficient temptation. The Barracouta or Barracuda (*Sphyræna*) is also mentioned, and the flying-fish (*Exocoetus*), attracted in the lagoon by torches, and caught in nets, formed a valuable source of food. A shark was caught and can be readily identified as the "Thresher" (*Alopias vulpes*) from a drawing made by Mr. Hedley. This shark is known as "Mungo" to the natives. There is evidence of another shark, for the swords figured by Edge-Partington,* as possibly from the Ellice Group, are armed with teeth, evidently those of *Galeocerdo rayneri*.

Mr. Hedley described to me a fish which there was small difficulty in recognising, and on showing him illustrations of *Epibulus insidiator*, he at once identified them as portraying the fish he described. A species extremely variable in colour, the example seen was wholly yellow.

A Diodon (or rather portion of the skin) was brought home ; it was found on the beach, and as it consists of nothing more than spines held together with skin, the species cannot be determined.

Mr. Hedley brought us some account of a large fish found off the Coral Atolls, known to the natives as "Palu," and to the traders as "Oil fish." It is only caught in the deepest water, and is described as having an immense head, enormous jaws, and large scales. I would hazard the suggestion that it is one of the *Macruridæ*, and as little, if any, information has been published about the "Palu," have pleasure in transcribing the following account, for which we are indebted to Mr. W. S. Crummer, of the Department of Lands, Sydney, who received it from the well known traveller and author, Mr. Louis Becke :—

"This peculiar fish is, as far as I know, only found in the Tokelau (or Union Group), the Ellice Group, the Kingsmill Group, and at the isolated islands of Pukapuka (Danger Island), Suwarrow Island, and Manahiki. I do not know for certain, but have been told by many intelligent natives, that the 'Palu' is never to be found among the high islands, such as the Fijis,

* J. Edge-Partington—Ethnological Album (1), i., pl. xxxvii., figs. 6-11.

Samoa, New Hebrides, etc.; that it affects only the low-lying coral atolls, such as the above-named. With the exception of an old trader named Jack O'Brien, now living in Funafuti, in the Ellice Group, I do not think there is among the white traders of to-day another man besides myself who has caught 'Palu.' In the first place, a man must have much experience of deep-sea fishing; in the next, the native inhabitants would strongly resent a strange white man attempting to catch one, for reasons I will explain hereafter—that is, the people of the Line Islands would so resent it.

"A full-grown 'Palu' would weigh up to 150lbs., and be 6ft. long; it being by no means a thick fish; as far as shape goes it is much like the Australian Jew fish. In place of scales it possesses a tough black skin, thickly covered with bright silvery and small horny excrescences growing in the same manner as the feathers of a French fowl—that is, these scales, or whatever you can call them, curl upwards, and feel loose to the touch. The most peculiar features of the 'Palu' are the enormous eyes; the jaws are toothless; the fins resemble those of a Jew fish. The average size is about 3 or 4ft., and weight 40 to 60lbs.

"The ingeniously constructed wooden 'Palu' hook you are already familiar with, so I need not here say anything about it. The line most in favour for 'Palu' fishing is made from the very best cocoanut fibre, 4 or 6 plait. This is of great strength, *and above all* very light, for it is not unusual to fish in 150 to 200 fathoms, and at such a depth as that the lines, made from 'fetau' (Hibiscus), would be too heavy to pull in. A stone sinker, 3 to 5lbs., is attached to the line.

"A calm smooth night is chosen, and after catching flying fish for 'Palu' bait, the canoes pull out into the open—always on the lee side. It is customary to observe the strictest silence, the natives having many superstitions in regard to 'Palu' catching, which is always conducted in a quiet, noiseless manner, different from 'Bonito' fishing, where everyone yells and howls, and works himself into a frenzy.

"The bite of the 'Palu' is hardly perceptible, but on the Island of Nanomaga, in the Ellice Group, where I was left twelve months, I do not remember an instance where we did not touch bottom at 120 fathoms, and almost immediately pull up with a 'Palu' hooked. The hauling up is done very slowly till the fish is within 30 or 40 fathoms, and then as fast as possible to avoid the big *Tanifa* sharks that would seize the fish. Sometimes in 'Palu' fishing we have hooked immense brown eels which, unless our united strength was put on the line, would tie themselves round the coral and cut the line. In one of these eels we found a 'Palu' weighing 20lbs., just dead, showing that these brutes

prey on the 'Palu.' When each canoe has caught two 'Palu' they paddle ashore.

"The fish are apportioned out to the community with the greatest exactitude—every portion of it is edible; the head, bones, and fins, when cooked, turning into a rich mass of jelly. The flesh of the 'Palu,' if left uncooked, never putrefies; it simply dissolves into a colourless and odourless oil—I believe chemists would like to get hold of 'Palu' oil. When cooked, it is not easy to detect any great difference from the flesh of other fish, except that it looks very rich and is dully transparent. Its almost immediate effect on the bowels I have described to you before.

"It is prized above all other fish in the Line and Ellice Groups. In the Line Islands it is called 'Te icka ne peka'—hardly translatable in polite English; but not to be too coarse we will say it means 'the fish that makes you obey the call of nature in double quick time.'

"When I was living on Savage Island, the people then told me that in the older times 'Palu' were caught there, but of late years very rarely, and that the strong currents racing round the island made them (the natives) afraid to venture out at night; but I surprised them when, with two old warrior fishermen, I caught five 'Palu' in one night, in 80 fathoms only, and with a steel fish-hook. I set the fashion, and the extinct art was revived during my stay there, and I sold any amount of fishing lines and 8-in. hooks, as the Nuie people hate to make anything they can buy or steal."

Three types of Funafuti native instruments, in which portions of fishes have been made use of, have been submitted to me.

One, called a rasp, is simply a dried portion of the tail of *Urogymnus asperimus*. The skin of this ray, as is well known, is in common use for covering sword and spear handles, etc.

A second, described as a thatching needle, is formed of about nine inches of the beak of a Sword Fish (*Histiophorus*). Another needle used for a similar purpose is the caudal spine of one of the larger Sting Rays (*Trygonidae*), the serrations having been ground down to render the tool sufficiently smooth. The native name of the ray is "Feimanu."

A number of lancets form a third type. They are very neatly made of a piece of stick cleft at the end, into which is lashed a shark's tooth. The teeth are possibly from *Carcharias lamia*; those from the lower jaw would make admirable lancets, but personally I should not care to be operated upon by the serrated teeth of the upper jaw—both types of teeth having been similarly utilised.

THE ENTEROPNEUSTA OF FUNAFUTI.

PART I.

BY JAS. P. HILL,

Demonstrator of Biology in the University of Sydney.

[IX.]

THE ENTEROPNEUSTA.

PART. I.

BY JAS. P. HILL,

Demonstrator of Biology in the University of Sydney.

[Plate IX.]

THE Collection of Enteropneusta brought by Mr. Charles Hedley from Funafuti, and which I have had the privilege of examining through the kindness of Mr. R. Etheridge, Junr., Curator of the Museum, comprises two distinct and widely separated species belonging to the genus *Ptychodera*.

One of these species is identical with a species found by Dr. Arthur Willey at three distinct localities in the New Caledonian Archipelago, and of which he has already communicated an account to the "Quarterly Journal of Microscopical Science."* Dr. Willey has most kindly sent me his collection for comparison with that made by Mr. Hedley, together with an account of his observations. I am thus enabled to speak definitely on the identity of these two forms. Willey has referred the species concerned provisionally to *Ptychodera flava*, Eschscholtz,† recorded from the Romanzoff Group of the Marshall Archipelago in 1825, and has suggested that until the Marshall Islands' form is re-examined it might be advisable to call the New Caledonian form *P. flava caledonica*, or simply *P. caledonica*. Now, however, that the same form has been found to occur at such a distinct and widely separated, but intermediate locality as Funafuti, Willey proposes (*in litt.*) to drop the name *caledonica*, and to regard the species, provisionally at least, as *P. flava*, Eschsch., in the amended sense.

The specimens of this species obtained by Mr. Hedley do not exceed 3 inches in length. Willey gives $2\frac{1}{2}$ inches as the maximum length of unextended specimens obtained at the islet of Amédée, close to Noumea, while specimens found by him later at

* In the press.

† J. W. Spengel—Die Enteropneusten des Golfes von Neapel, etc. Fauna u. Flora des Golfes von Neapel, 1893. pp. 190-1, fig. P.

Lifu, in the Loyalty Islands, were much larger, extending to 7 or 8 inches in length, (*in litt.*).

The other species in the Funafuti collection is new to science. I propose to associate it with the name of Mr. Hedley.

FAMILY PTYCHODERIDÆ.

PTYCHODERA, *Spengel*.

PTYCHODERA HEDLEYI, sp. nov.

DESCRIPTION.

Mode of Occurrence and External Characters.—Mr. Hedley has supplied me with the following field notes: "The centre of the principal islet of Funafuti Atoll is occupied by a large bare flat, surrounded by a hedge of *Rhizophora*—this locality is described (*ante* p. 10) as the Mangrove Swamp. At the north end of this, near the holes through which the tide ebbs and flows, are numerous, shallow, sandy or muddy puddles covered at half tide; the most prolific being some under the shade of the mangroves. In such a puddle, 3 inches deep and 2 feet across, a dozen specimens might be found. The animals were best secured by taking up a handful of wet mud and combing the fingers carefully through it. The primrose yellow of the *Ptychodera* distinguished the least exposure of its body, and it was carefully washed off the fingers into a vessel of water. Even with care many specimens were torn. The two species were found associated together."

The external characters alone suffice to mark off this species from all the described species of the genus *Ptychodera*.

P. flava, as Willey has shown, is at once characterised by the great development and extreme ventral origin of the genital wings (or better, genital pleura, as Willey has suggested), and thus belongs to Spengel's provisional subgenus *Chlamydothorax*, of the family Ptychoderidæ. *P. hedleyi*, on the contrary, is entirely devoid of genital pleura, and is hence to be associated with *P. minuta* and *P. sarniensis*, in the subgenus *Ptychodera* (*sensu stricto*). The complete specimens of this species at my disposal vary in length from about 6 to 14 cm.

Mr. Hedley supplies the following notes on the mode of preservation: "On arriving at the camp, the tube containing the take of *Ptychodera* was emptied into a photographic dish filled with sea water; a little cocaine was added, which seemed to induce the animals to crawl about freely. After four or five hours they had rid themselves of mud and mucus, and were killed by a weak solution of chromic acid. Having remained in this for twelve hours, they were finally transferred to three per cent. solution of formol."

Proboscis.—The proboscis of this species, like that of the *P. minuta* and *P. sarniensis*, is relatively short. It has a greatest length of 9 mm., and a breadth of 5 mm., i.e., its length is not quite double its breadth. In form it is somewhat egg-shaped, or more accurately, its outline may be compared with that of the human tongue. A distinct median sulcus is present, on its dorsal surface, in some specimens, but not in all, and may simply be due to contraction in preservation.

Collar.—The collar appears about as broad as long, with a greatest length and breadth each of 5 mm. It is considerably shorter than the proboscis, in the proportions of 5 : 9 and 4 : 7 in two individuals.

The five regions of the collar are distinct, and in their relations are characteristic for the species. The first region includes the anterior free part of the collar, and occupies about a third of its entire extent. Its free margin is slightly crinkled, but is not markedly expanded frill-like, as in *P. australiensis*.^{*} This free part of the collar narrows posteriorly, and passes over into the second region, occupying the middle third of the collar.

This second region appears of a darker colour than the first, and is somewhat broader than the latter. It forms a distinct circular cushion, narrowing anteriorly where it joins the first, and broader posteriorly where it adjoins the third region. The posterior third of the collar, constituting its broadest portion, includes the third, fourth, and fifth regions.

The third and fifth regions are formed by two prominent circular ridges of about equal size, and are separated from each other by a circular groove constituting the fourth region. The circular rim of the fifth region forms the posterior margin of the collar, and has a distinctly greater transverse diameter than the succeeding branchio-genital section of the trunk, so that the collar appears distinctly marked off from the latter.

In the specimens the collar shows distinct longitudinal grooves, no doubt produced by the contraction of the collar musculature.

TRUNK.

(1.) *Branchio-genital Region*.—This region is characterised by the great length of the branchial area, and the absence of genital pleura, the latter however being represented in the genital region proper by genital cushions (cf. *infra*).

It may be subdivided into a branchio-genital region, co-extensive with the gill area, and into an exclusively genital region behind the point of termination of the gills. In the largest

^{*} J. P. Hill—On a New Species of Enteropneusta (*P. australiensis*), from the Coast of New South Wales. Proc. Linn. Soc., N.S.W. (2), x., 1894.

specimen in the collection the gill area has a total length of 3.3 cm. It is thus relatively much longer than in *P. minuta* and *P. sarniensis*, and is also of a different shape. In these forms the gill area, when viewed from above, presents, as Spengel describes it, the appearance of an elongated narrow triangle with its apex pointing posteriorly. In *P. hedleyi*, however, the gill area, viewed from above, appears long and band-like, and is not pointed at its posterior end. The gill pores open on each side into a narrow longitudinal groove, which runs parallel with the deep median groove, marking the position of the dorsal nerve cord. The narrow bands of epidermis lying, one on each side, between the median groove and the branchial grooves, and hardly .5 mm. in width, are divided up by transverse lines into a definite and fairly regular series of oblong or squarish areas, characteristic for the species. The openings of the gill cavities into the branchial grooves can only be made out in sections.

Laterally to the branchial grooves, the epidermis is irregularly, but very markedly annulated, the annulations being interrupted below by the median ventral groove marking the course of the ventral nerve cord. This ventral groove is much shallower than the dorsal. In the branchial region the trunk is almost quite cylindrical, measuring in greatest breadth 4.75 mm. It is not possible, in this region, to speak of genital cushions, such as Spengel* describes and figures for *P. minuta* (taf. 2, fig. 10), and *P. sarniensis* (taf. 6, fig. 7). Indeed, sections through the branchial region of *P. hedleyi* more closely resemble in general form the section, figured by Spengel, through the branchial region of *Glandiceps talaboti* (fig. 13, taf. 19), than similar sections of *P. minuta* and *P. sarniensis*.

Behind the branchial region proper there is a short exclusively genital segment of the trunk, characterised by its greater transverse breadth and the presence of distinct genital cushions, similar to the much more extensive cushions described by Spengel for *P. minuta* and *P. sarniensis*. This region, in a fragment of a large and apparently sexually mature individual, has a length of 15 mm., with a transverse breadth of 6 mm. It not only exceeds the branchial region in breadth but presents in sections a very different outline—ventro-laterally it is rounded, while dorsally it is markedly concave on each side of the median ridge formed by the dorsal nerve cord. The genital cushions are the direct continuations of that portion of the epidermis forming the lateral boundary of the branchial grooves. They form low and thick lateral ridges, extending from the posterior end of the branchial region up to within a short distance of the most anterior liver sacs.

* *Loc. cit.*

Behind the branchial region the dorsal nerve cord no longer lies in the bottom of a groove but forms a median ridge, traceable to the posterior extremity of the tail. Just in front of the anus, however, it becomes much less marked, and may even fade away from view. The ventral cord similarly comes to the surface at the end of the branchial region and passes as a median whitish line up to the extreme posterior end of the tail.

The gonads extend throughout the whole extent of the branchio-genital region up to within a short distance of the anterior liver sacs.

(2.) *Hepatic Region*.—May reach a length of 27 mm., and a breadth of 5.5 mm. The number of liver sacs in the larger specimens varies from fifty to sixty on each side. The sacs are arranged in two distinct and uniform longitudinal rows. Anteriorly, they commence abruptly, just behind the point of fading away of the genital cushions, while posteriorly they gradually become smaller, and pass over without definite limit into the transverse annulations of the dorsal region of the tail. The most anterior and posterior sacs are colourless in the preserved specimens, while the remaining sacs, as well as the ventral portion of the body wall in the hepatic region, are of a light slaty brown colour. The three or four pairs of anterior liver sacs are somewhat smaller and thicker antero-posteriorly than the succeeding ones. The latter are simple, markedly compressed antero-posteriorly, and situated close together so that the anterior and posterior faces of the adjacent sacs touch. Each sac has a broad base of attachment corresponding in transverse extent with its free part. The outer ends of the sacs thus do not project freely so as to overhang the lateral body wall, though owing to the lesser transverse breadth of the ventral half of the hepatic region it is not visible when the region is viewed from above. The line of attachment of the outer ends of the sacs is marked on each side by a low longitudinal ridge, continuous in front with the genital cushion.

(3.) *Tail Region*.—In the largest complete specimen this region is about twice as long as the hepatic region, and measures 5.3 cm. in length, with a breadth of 5 mm. In this species, as in *P. australiensis*, the tail region is characterised by the presence of two dorso-lateral epidermal lines, corresponding to the two underlying ciliated grooves of the intestine. The lines extend from the hepatic region over the anterior two-thirds of the tail, running parallel with the dorsal nerve cord, and about .5 to .75 mm. distant from it. They enclose between them a band-like area of the dorsal body wall, with the dorsal cord running along its middle, and appearing like a direct backward prolongation of the hepatic region. On each side of the nerve cord the area often

appears slightly depressed, and thus stands out very distinctly. It is crossed by a numerous series of close set epidermal ridges, which may even extend continuously across the dorsal cord. Laterally, the ridges may either stop short at the epidermal lines, or may pass across them to become continuous with the annulations of the ventro-lateral body wall. These latter are invariably interrupted at the ventral nerve cord.

In *P. flava*, Willey has also recorded the existence of two dorso-lateral bands in the tail region, but as he describes them, these bands, which are visible externally do not cause any interruption in the annulations or islets of the integument, and in fact are probably only the ciliated bands of the intestine showing through the epidermis by transparency.

Behind the termination of the epidermal lines the tail gradually narrows to its posterior end. In this posterior region the epidermal annulations may, in some specimens, be partly broken up into small islands. The annulations of the tail region are, on the whole, more regular than those of the branchio-genital region.

In Part II. I propose to describe and figure the salient features in the internal anatomy of this species.

THE ALCYONARIA OF FUNAFUTI.

PART I.

By THOMAS WHITELEGGE.

Zoologist, Australian Museum.

[X.]

THE ALCYONARIA.

Part I.

BY THOMAS WHITELEGGE,

Zoologist, Australian Museum.

THE *Alcyonaria* collected at the Ellice Group by Mr. C. Hedley, prove to be of more than ordinary interest, inasmuch as the Collection now dealt with includes four new species, and many rare or but little known forms.

There are three species of the genus *Sarcophytum*, one of which was originally described by Dana as *Alcyonium latum*, from Fiji; herein it is referred to the genus *Sarcophytum*, to which it undoubtedly belongs.

The genus *Lobophytum* is represented by six or seven species; two are described as new, and four others have been re-described and illustrated, with a view to aid in their determination in the future.

In dealing with the species described by the earlier authors, there is a considerable amount of doubt as to their specific identity, from the fact that the characters afforded by the spicules have generally been ignored, and only the external features given. In such cases I have thought it better to accept the species, when they agreed fairly well with the descriptions, rather than describe them as new.

Under this category are included *Alcyonium tuberculatum*, Q. & G., *A. confertum*, Dana, and *A. viride*, Q. & G. The latter appears to differ greatly from the other species under notice, and Studer refers it to the genus *Lobularia* in his account of the *Alcyonaria* of S.M.S. "Gazelle."* Judging by the spicules alone, the species herein enumerated and referred to the genus *Lobophytum* are very heterogeneous, displaying great variation in the size and also in the tuberculation of the larger spicules; the tubercles are not in whorls but are irregularly scattered, this is so in *L. tuberculatum*, *L. confertum*, and *L. densum*, which in this respect are closely allied to *L. marenzelleri*, and also in the size of the siphonozooids, which are minute and almost rudimentary.

* Monatsb. Akad. Wiss. Berlin, 1878, p. 634.

The *Nephthyidæ* are represented by two species of *Spongodes*, one—*S. pallida*—being regarded as new.

Of the genus *Siphonogorgia* no less than three out of the seven known species are in the Collection, together with a new species possessing very large spicules, the external ones of which resemble those of *Spongodes*.

I have again to acknowledge my obligation to my colleague, Mr. Edgar R. Waite, for the admirable pen and ink drawings, from which the accompanying illustrations were photographically reproduced.

Mr. Charles Hedley supplies the following field notes:—

"The *Alcyonidæ*, such as *Lobophytum* and *Sarcophytum*, especially flourished on the numerous small reefs which stud the lagoon, where they grew from low water to as deep as the eye could follow. Like the hard corals with which they were interspersed, they loved clear, smooth water, and a rocky bottom, and could not endure sand or mud. So plentiful were they in such spots, that I have often walked for twenty or thirty paces treading upon *Alcyonaria* continuously. So much do these resemble in a general way some of the hard corals, among which they grow, that I have often stooped to feel whether the object of my attention were hard or soft. On shady days the polyps might be seen fully exserted, but in bright sunshine they were invariably retracted. All the specimens collected were taken at low water by wading on the lagoon reefs opposite the anchorage.

"The *Nephthyidæ*, embracing *Spongodes* and *Siphonogorgia*, could not be reached but by one having steam power at command. The only day a steam launch was placed at my disposal, I spent the time dragging tangles across and along the steep and narrow slope west of the atoll, between forty and seventy fathoms. From this rocky mountain side were procured one species of *Spongodes*, four species of *Siphonogorgia*, and a number of *Gorgonias*." These latter will be dealt with in the next Part.

ALCYONARIA.

FAMILY ALCYONIDÆ.

SARCOPHYTUM GLAUCUM, Quoy & Gaim.

Sarcophytum glaucum, Quoy & Gaim., Voy. Astrolabe, Zoophytes, iv., p. 270, pl. xxii., figs. 11-12; Marenzeller, Zool. Jahrb., Bd. i., 1886, p. 352, pl. ix., fig. 12; Wright & Studer, Chall. Rep., Zool., xxxi., p. 248, pl. xlii., fig. 3.

Four well preserved specimens, with the polyps mostly extended.

SARCOPHYTUM TROCHELIOPHORUM, var. AMBOINENSE, Marenz.

Sarcophytum trocheliophorum, var. *amboinense*, Marenz., Zool. Jahrb., Bd. i., 1886, p. 361, pl. ix., fig. 6; Wright & Studer, Chall. Rep., Zool., xxxi., p. 249, pl. xli., fig. 11.

One small specimen, the polyps are quite retracted, the siphonozooids are distinct and disposed in circles. The short thick spicules are characteristic of this form. (See fig. 6c on Marenzeller's plate.)

SARCOPHYTUM LATUM, Dana.

(Plate x., figs. 1a-f.)

Alcyonium latum, Dana, Zooph. U.S. Explor. Exped., pl. lviii., figs. 6, a, b, b; Synop. Rep. Zooph., 1859, p. 125.

The single example obtained, differs slightly from the type as figured by Dana; it is smaller, more depressed, and the lobes are fewer.

The sterile column is well developed, it is 55 mm. high at its highest point, and 30 mm. at its lowest; the surface is longitudinally sulcate and very harsh to the touch.

The capitular margin is a little swollen, but not at all revolute, the upper surface generally presents a minutely beaded appearance, due to the elevation of the walls surrounding the orifices of the polyps.

The autozooids, which are 1 mm. apart, are encircled by six or seven siphonozooids, the latter being also common to the encircling series of adjoining autozooids, as shown in Dana's fig. 6a.

The cœnenchyma spicules are abundant, and consist of fusiform, and of subcylindrical spindles, studded with whorled, granular, or spiny tubercles. Size—·3 by ·08, ·4 by ·1, ·3 by ·15, ·35 by ·15 mm. In addition to these, there are a few crosses and comparatively smooth spiny spindles.

The spicules of the cortex are tuberculated clubs, which form a very dense crust, they are variable at the blunt end, some are broad and others obliquely pointed. Size—·12 by ·03, ·2 by ·04 mm.

The specimen has the same general shape as that figured by Dana, consisting of two subfoliate expansions; there is evidently an error in fig. 7, the right half having the sterile column coloured and dotted to represent polyps similar to those on the capitular surface.

The spirit specimen is dark stone colour.

LOBOPHYTUM PAUCIFLORUM, Ehr., var. *VALIDUM*, Marenz.

Lobophytum pauciflorum, Ehr., var. *validum*, Marenz., Zool. Jahrb., Bd. i., p. 367, pl. ix., fig. 12, a, b, c.

One specimen 80 mm. long by 52 mm. wide, the sterile column is 25 mm. high, with a somewhat even surface, excepting at one point, where it exhibits a few transverse wrinkles.

The capitular margin is slightly thickened, and a little revolute in some parts.

The lobes of the capitulum are abruptly rounded at the summits, they are about ten in number and vary from 15 to 25 mm. in height, 15 to 40 mm. in width, and from 7 to 10 mm. in their least diameter.

The autozooids are 2 mm. apart, the walls surrounding the orifices are slightly raised, and a shade darker in colour than the rest of the surface.

The siphonozooids are numerous, small, and scarcely visible to the unassisted eye; there are from five to seven between two autozooids.

The spicules do not differ from those figured by Marenzeller.

The specimen in spirits is a dark stone colour.

LOBOPHYTUM HEDLEYI, sp. nov.

(Plate x., figs. 2a-h.)

There are three examples, exhibiting great variation in the lobation of the capitulum.

In the larger specimen the sterile column is complete, rigid, and harsh to the touch, longitudinally plicate, and measures 50 mm. in diameter and 35 mm. in height.

The capitulum consists of about twelve subflabellate lobes from 20 to 40 mm. high, 25 to 45 mm. wide, and from 5 to 8 mm. thick.

The primary lobes are divided into three or four secondary lobes, 10 to 15 mm. high, and 5 to 10 mm. wide. Many of the broader lobes have a longitudinal fold commencing at the base and continued to the subtruncate apex.

In the two smaller examples, both the primary and secondary lobes are much narrower, the latter often digitate, compressed, or subcylindrical, with evenly rounded summits, the wider lobes exhibit a rather broad median longitudinal groove on at least one side; on the widest lobes the grooves are present on both sides. The primary lobes are from 8 to 30 mm. wide, 10 to 25 mm. high, and from 3 to 7 mm. thick; the secondaries from 5 to 20 mm. high, 5 to 10 mm. wide, and from 2 to 5 mm. in their narrow diameter.

The autozooids are very irregularly disposed; they are few in number, and on the central regions of the lobes separated from each other by wide intervals. On the margins and summits of the lobes they are closer, and about 1 to 2 mm. or even less apart.

The siphonozooids are numerous, distinct, and plainly visible to the unassisted eye; between the widely separated autozooids there are as many as twelve, whilst on the margins, where the autozooids are crowded, they are fewer and disposed in circles.

The spicules of the cœenchyma consist of—

(1.) Straight rather acute ended spindles, the smaller of which are often unequal and subclavate. The tubercles are in whorls and somewhat minutely spinose. Size—.15 by .03, .3 by .09 mm.

(2.) Short, stout, subcylindrical, with from four to six whorls of spiny tubercles. Size—.15 by .07, .2 by 1 mm.

In addition to the foregoing there are numerous spiny spindles and some crosses. The spicules of the cortex are rather narrow tuberculated clubs. Size—.12 by .02, .15 by .05 mm.

The colour in spirits is umber.

Reg. No. G. 1537.

LOBOPHYTUM MARENZELLERI, Wright & Studer.

Lobophytum marenzelleri, Wright & Studer, Chall. Rep., Zool. xxxi., p. 251, pl. xlii., fig. 1.

One specimen of an oval shape, 80 mm. long and 40 mm. wide. Only a small portion of the sterile column remains, it is 30 mm. high. The lobation of the capitulum, autozooids, siphonozooids and spicules, agree with the published description.

The specimen is of a yellowish-white colour.

LOBOPHYTUM TUBERCULOSUM, Quoy & Gaim.

(Plate xi., figs. 3a-f.)

Lobophytum tuberculosum, Quoy & Gaim., Voy. Astrolabe, Zooph., iv., p. 274, pl. xxiii., figs. 4-5.

In a small example referred to this species the sterile stem is mostly torn away, the remaining portion is 15 mm. high and 25 mm. wide.

The capitulum is 80 mm. long, 60 mm. wide, and 20 mm. high.

There are seven primary lobes arising from the expanded base, each bearing from five to twenty secondary round, oblong, or subreniform lobes, their height seldom exceeding their lesser diameter.

The autozooids are crowded, with the margins of the orifices deeply sunk, they are from .5 to 1 mm. apart.

The siphonozooids are exceedingly minute and the orifices difficult to see even with a strong lens. Their number is from two to four between two autozooids.

The spicules of the cœnenchyma are straight, or curved, irregularly tuberculated spindles, displaying great variation in outline; some are cylindrical to within a short distance of the ends, where they taper rapidly to rather blunt points, others are clavate with the narrow end acute, and a few taper gradually to acute points. Size—·5 by ·12, 2 by ·4 mm.

The cortical spicules are small clubs with tuberculate heads and spiny sharply pointed shafts. Size—·15 by ·04, ·25 by ·07 mm. There are also a few smooth or slightly spiny spindles; crosses have not been observed. The colour in spirits is yellowish-gray.

LOBOPHYTUM CONFERTUM, Dana.

(Plate xi., figs. 5a-e.)

Lobophytum confertum, Dana, U. S. Explor. Exped., Zooph., pl. lvii., fig. 7, a, b; Synop. Rep. Zooph., 1859, p. 125.

One specimen in which the sterile column is absent is with some hesitation referred to this species. The colony is very hard to the touch, and densely charged with large spicules, which can be seen with the unaided eye projecting from the broken surfaces.

The capitulum consists of eight or nine main lobes, upon which are situated a large number of secondary lobes, varying greatly in shape; on the basal expansion they are subcylindrical or compressed and are from 4 to 15 mm. high, and 3 to 5 mm. thick. Along the sides of the primaries the secondaries form low ridges which extend in a more or less broken manner from the bases to the summits, they are about as high as broad. The apical and subapical lobes are very variable, scarcely any two being alike; they may be round, trigonous, or much compressed, with a slight longitudinal groove, and the margins folded towards each other; they are from 5 to 15 mm. high, 3 to 10 mm. in their broad, and from 3 to 5 mm. in their narrow diameter.

The autozooids are evenly distributed, the marginal walls of the orifices deeply sunk; they are tolerably uniformly spaced, being 1 mm. apart.

The siphonozooids are so minute that a high magnifying lens fails to render them visible.

The cœnenchyma exhibits when viewed in transverse section a large number of canals from ·5 to 2 mm. in diameter; the walls are thickly charged with very large tuberculate spindles.

The tubercles are small, close, rather indistinctly whorled and minutely granular; some of the larger spicules have spines only,

they appear to be less opaque than those bearing tubercles, and the spines can be seen radiating from the axial region of the spicule.

The spicules of the cœnenchyma vary considerably, and may be enumerated as follows :—

(1.) Large, curved or rarely straight, very variable both in the amount of curvature, and the acuteness of the points; most of those evenly curved, whether boomerang, bow or *f*-shaped, have moderately sharp points, whilst those unequally curved usually have one end blunt. Size—1·7 by ·25, 2·5 by ·4 mm.

(2.) Straight, fusiform, equally tapering to sharp points. Size—1·4 by ·22 mm.

(3.) Straight, subcylindrical, with rounded ends. Size—·8 by 15 mm.

(4.) Large, straight, or curved, fusiform with spines only. Size—1·4 by ·22, 2· by 45 mm.

The cortical spicules consist of :—

(1.) Comparatively smooth fusiform spindles, with small tubercles or spines. Size—·45 by ·08 mm.

(2.) Straight, spiny, almost cylindrical. Size—·35 by ·05 mm.

(3.) Clubs with tuberculate heads and long spiny shafts. Size—·2 by ·04, ·25 by ·05 mm.

The colour is coffee-brown, but this may be due to staining caused by contact with other objects in the cask in which the specimen was preserved. This is highly probable, as a second example which at first sight was thought to be distinct, proves to be the same, or perhaps a variety.

The colour of the second specimen is pale glaucous or sage green, the primary lobes are not so high, the secondary lobes are shorter, thicker, and mostly in contact, each lobe being adapted to the shape of contiguous lobes. A small portion of the barren stem is present and exhibits a few longitudinal plications, but it is comparatively smooth to the touch. Other characters, such as the size of the autozooids, their distance apart, the rudimentary siphonozooids, and the spicules, are very similar, and offer no marked points of difference.

LOBOPHYTUM DENSUM, sp. nov.

(Plate xi., figs. 4a–h.)

The colony is 70 mm. long, 45 mm. wide, and 60 mm. high. About half of the sterile column is wanting, the height of the remaining portion varies from 15 to 35 mm. in height. The cœnenchyma is thickly charged with large spicules, giving the stem when viewed in transverse section a solid appearance, the longitudinal canals are not perceptible to the unassisted eye.

The capitulum consists of numerous digitate lobes, mostly simple, but some of the larger centrally situated give off from three to five secondaries. The lobes are more or less compressed with obtusely rounded summits, they are from 5 to 35 mm. high, 4 to 12 mm. in their narrow, and 7 to 15 in their broad diameter.

The autozooids are few and distant at the bases of the lobes, elsewhere they are evenly distributed, and are from .5 to 1. mm. apart

The siphonozooids are minute, and the orifices difficult to distinguish even with a strong lens.

The cœnenchyma spicules are very large, and exist in such numbers that the colony is almost of stony hardness. They usually consist of straight or but little curved tuberculated spindles, somewhat thick in the middle and tapering to sharp points, some few have one end blunt, and occasionally branched; the tubercles are irregularly disposed.

The measurements of the spicules are as follows :—

(1.) Large, fusiform, with simple spine-like tubercles, and usually with a transverse median constriction. Size—1. by .2, 2.4 by .5.

(2.) Large, fusiform, subcylindrical or subclavate, closely tuberculate, the tubercles are thickly studded with minute spiny warts. Size—8 by .2, 1.4 by .35, 2. by .5, 4. by .9 mm.

(3.) Smaller fusiform, strongly but distantly tuberculate. Size—.35 by .1, .65 by .15 mm.

(4.) Small fusiform, comparatively smooth, with spines. Size—.5 by .09, .6 by .1 mm.

The cortical spicules consist of short spiny spindles and clubs.

(1.) Spindles : Size—.25 by .03.

(2.) Clubs : Size—.1 by .03, .13 by .03 mm.

The colour in spirits is pale brown, with the grooves and pits darker.

Reg. No. G. 1541.

LOBULARIA (?) VIRIDE, Quoy & Gaim.

(Plate xii., figs. 6a-d.)

Alcyonum viride, Quoy & Gaim., Voy. l'Astrolabe, iv., p. 272, pl. xxiii., figs. 22-23.

Ten specimens, very soft and flexible, displaying great variation in the terminal lobes, some being cylindrical, others broad and compressed or forming a series of rounded undulations on the summits of the flabellate branches.

The sterile column in a perfect example is largely developed, it is 60 mm. high and 50 mm. in diameter.

The capitulum consists of five primary branches from 20 to 50 mm. wide, 20 to 40 mm. high, and from 5 to 8 mm. thick. The secondary lobes are from 8 to 30 mm. high, 7 to 25 mm. wide, and from 3 to 7 mm. thick, with broadly rounded apices.

In another example the primary branches are from 50 to 75 mm. wide, 20 to 50 mm. high, and from 5 to 7 mm. thick, the upper margins having only slight indications of lobes, the central primary branch has nine low rounded elevations, the highest being 10 mm. high and about the same in width.

The autozooids are irregularly disposed from 1 to 5 mm. apart, and are much closer together on margins and apices of the lobes than on the intervening spaces.

The siphonozooids are numerous, large and visible to the unaided eye, varying greatly as to the number between the autozooids; usually there are two or three to 1 mm.

The cœnenchyma of the sterile stem and of the capitulum is charged with similar spicules, and I have been unable to detect any special dermal layer in the capitulum. There exists a cortical layer of spicules on the barren stem, consisting of small almost smooth clubs with very few tubercles, and some short irregularly shaped spindles with blunt ends.

The cœnenchyma spicules are as follows:—

(1.) Tuberculed spindles with the tubercles in well marked zones. Size—.2 by .05, .35 by .1 mm.

(2.) Short, subcylindrical, with from four to six whorls of tubercles. Size—.19 by .08, .23 by .1 mm.

Cortical spicules of the sterile column:—

(1.) Smooth spindles, with a few low rounded tubercles. Size—.1 by .02 mm.

(2.) Clubs with smooth tubercles. Size—.15 by .03 mm.

The colour in spirits is olive-gray.

There are two small specimens which differ in being of a delicate greenish-yellow, and the sterile stem is rougher to the touch, but the other characters appear to be the same, and the spicules are indistinguishable from those of the typical form.

FAMILY NEPHTHYIDÆ.

SUB-FAMILY SPONGODINÆ.

SPONGODES PALLIDA, sp. nov.

(Plate xii., figs. 7a-c.)

The colony arises from an encrusting base 15 mm. long, 8 mm. wide, and from 1 to 2 mm. thick.

There are three stems about equal in height and in distance apart; they are 10 mm. high, 3 to 5 mm. in diameter at their bases, and from 6 to 9 mm. at their summits.

The polyps commence at the bases of the stems, where they are arranged singly, irregularly, and at a considerable distance apart.

On the upper portions of the stems the polyps are in clusters of from three to twelve, and arise from very short secondary branches; on the central stem there are about thirteen such clusters, the largest of which is 3 mm. high and 5 mm. wide.

The polyp heads together with the stalks are from 1 to 1.5 mm. high, and from .07 to 1 mm. in diameter.

The solitary polyps are given off from the stem at right angles, whilst the clusters on the branches are radiate, and the apertures of many of the lower ones are directed towards the base of the stem.

The stem spicules are arranged transversely, and consist of slightly curved spindles with obtuse ends, having their surfaces closely beset with low rounded tubercles, which are generally smooth, but in some of the larger forms they are minutely denticulate.

Size—.5 by .09, 1.5 by .2 mm.

The spicules of the branches are shorter, stouter, and a little more curved than those of the stem.

The polyp heads have at their bases a number of transversely arranged spiny spindles with acute points. Size—.4 by .03 mm., .75 by .09 mm. From these there arise larger and longitudinally disposed spicules in pairs, each pair converging at their apices and separated at their bases. Usually one of each pair is longer and projects beyond the margin of the calyx.

These spicules are curved at the base, pointed at their free end, and covered with sharp spines. Size—.6 by .03, .8 by .05 mm.

The tentacular spicules are distantly spinose, and are arranged *en chevron*. Size—.12 by .02 mm.

The colour of the colony is uniform creamy-white. Obtained by the tangles at a depth of from 40 to 70 fathoms outside the reef.

Reg. No. G. 1543.

SPONGODES CURVICORNIS, *Wright & Studer*.

Spongodes curvicornis, Wright & Studer, Chall. Rep., Zool., xxxi., p. 220, pl. xxxvi., D., figs. 2, a, b.

One specimen dredged in about 20 fathoms in the lagoon.

The lower branches are connected and foliate or rosette-like as in the type specimen.

The spindle-shaped spicules on the stem and branches are large, numerous, and easily visible to the unassisted eye; those on the main stem are arranged more or less transversely, varying greatly in size, and are much more strongly spinose than the longitudinally disposed spicules of the branches.

The colour is yellowish-white, the branches and polyps are dark reddish-purple. The larger spicules often attain to a length of 6 mm.

SUB-FAMILY SIPHONOGORGINÆ.

SIPHONOGORGIA GODEFFROYI, *Kolliker*.

Siphonogorgia godeffroyi, Kolliker, Wright & Studer, Chall. Rep., Zool., xxxi., p. 236, pl. xxxviii., fig. 4.

There are two small broken specimens which I refer to this species, the larger of which is 25 mm. high and 5 mm. in diameter; the apex is wanting, the remaining portion consists of an erect stem giving off eight very short branches with terminal polyps. The stem is pinkish at the base, the upper part white, and the polyps very dark red. The longitudinally arranged spicules are large, and consist of straight or curved tuberculated spindles. Size—3· by ·3 mm.

Obtained at a depth of from 40 to 70 fathoms.

SIPHONOGORGIA PALLIDA, *Studer*.

Siphonogorgia pallida, Studer, Chall. Rep., Zool., xxxii., p. 8, pl. ii., fig. 2 a, b.

One example preserved in formol, in a much broken condition, the actual base is wanting and the upper terminal twigs are reduced to fragments.

The colony notwithstanding its damaged condition is 130 mm. high and 70 mm. wide, the main stem is laterally compressed, its widest basal diameter is 8 mm. and its narrowest 5 mm.

At a short distance from the base a large secondary branch arises, which is slightly less robust than the primary, the general appearance is like the figure on pl. ii. of the Chall. Rep., but the main and secondary branches are more undulate.

The polyps on the lower parts of the colony are in many instances quite flush with the surface, very few projecting like those on the slender twigs.

The colour is bright brick-red with yellow polyps.

In the walls of the canals there are numerous small spiny spindles, of a dark carmine colour, offering a striking contrast to the larger spicules which are yellowish-red by transmitted light. Size—15 by .01, .35 by .03mm.

SIPHONOGORGIA KOLLIKERI, *Wright & Studer.*

Siphonogorgia kollikeri, Wright & Studer, Chall. Rep., Zool., xxxi., p. 236, pl. xxiv., fig. 2; Studer, Chall. Rep., xxxii., p. 7, pl. i., fig. 2; pl. v., fig. 3; pl. vi., figs. 4-5.

One specimen with a slightly enlarged base, and measuring 100 mm. in height, but no doubt much higher when perfect; all the terminal twigs are broken.

The colony closely resembles the figure given by Studer, the large cone-shaped polyps being very characteristic.

The colour in spirits is coral-red.

Obtained at a depth of from 40 to 80 fathoms.

SIPHONOGORGIA MACROSPINA, sp. nov.

(Plate xii., figs. 8a-d.)

There are about twenty fragments of what appears to have been one colony. Judging by these fragments the growth was erect and in one plane, lateral branches being given off alternately at intervals of from 5 to 10 mm., but rarely at right angles; the largest branch measures 25 mm. in height, and gives off two alternate branchlets about 10 mm. apart. The thicker branches are a little compressed and 2 mm. in diameter, the slender terminal twigs are 1 mm. or less. The branches are rigid but exceedingly brittle owing to the large spicules and the paucity of the cœnenchyma.

The polyps occur at intervals of 3 mm. apart, and are arranged subspirally around the twigs either singly or in pairs, they are placed obliquely to their support, and provided with a slightly projecting calyx; there is a distinct operculum composed of grouped spicules arranged like a Λ , and a collar of transversely disposed spicules below the tentacles.

The longitudinally arranged cortical spicules consist of much curved or bent spindles, they are greatly elongated with slender acute points, and the surfaces closely studded with warty tubercles.

The walls of the nutrient canals are thickly charged with long, thin, spiny rods and spindles.

The spicules are as follows:—

(1.) Large elongate curved spindles, densely covered with warty tubercles and tapering to sharp points. Size—1.4 by 15mm., 2. by 21, 3. by 32, 4. by .35, 5.5 by .4, 6. by .45 mm.

(2.) Long subcylindrical spiny rods and spindles, abundant in the canal walls. Size—.6 by .02, 1.3 by .03, 1.8 by .04 mm.

(3.) Calicular spicules, spiny subfusiform, with the free ends acute. Size—.7 by 12, 1. by .15 mm.

(4.) Opercular spicules, distantly spinose. Size—.3 by .03 mm.

(5.) Collar spicules, curved and minutely spinose. Size—.25 x .02 mm.

The colour in spirit is bright yellow, polyps darker.

Obtained outside the reef at a depth of from 40 to 70 fathoms.

Reg. No. G. 1548.

EXPLANATION OF PLATE VIII.

Fig. 1. *Mus exulans*, Peale.

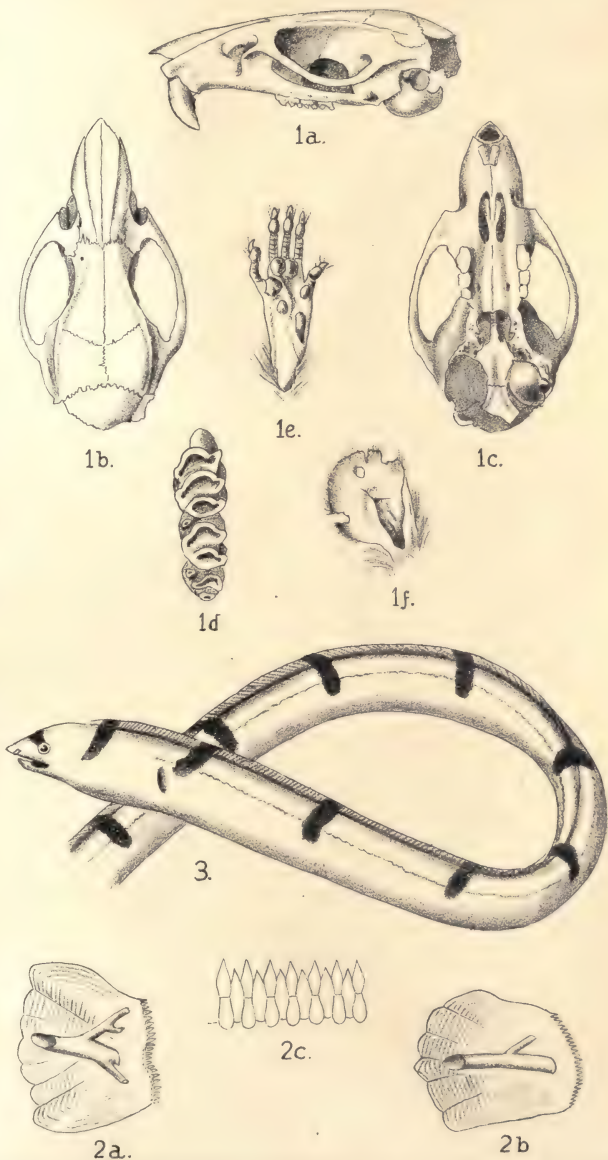
- a. Skull in profile; enlarged $1\frac{1}{2}$ diameters.
- b. Ditto, from above; ditto.
- c. Ditto, from below; ditto.
- d. Upper molars; greatly enlarged.
- e. Hind foot; natural size.
- f. Ear; ditto.

Fig 2. *Mulloidés samoensis*, Günther.

- a. Scale from anterior portion of lateral line, showing branched tube; enlarged.
- b. Scale from posterior portion of lateral line showing bifurcated tube; enlarged.
- c. Serrature of scale; greatly enlarged.

Fig. 3. *Ophichthys colubrinus*, Boddaert.

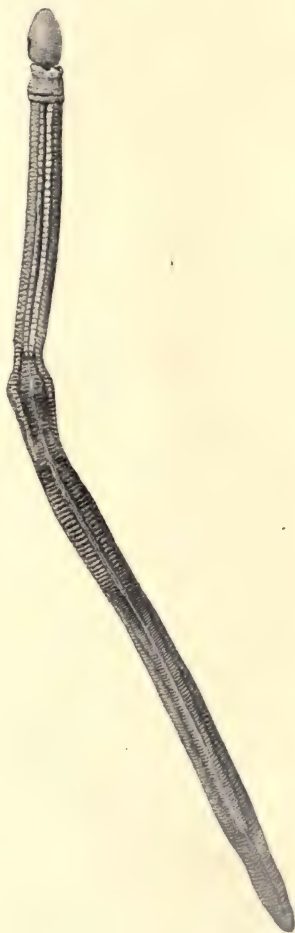
Anterior portion of body.



EXPLANATION OF PLATE IX.

Ptychodera hedleyi, sp. nov.

Seen from the dorsal aspect. From a preserved specimen, x $1\frac{1}{2}$.



EXPLANATION OF PLATE X.

Fig. 1. *Sarcophytum latum*, Dana.

- „ a, b, c, d. Spicules from the cœnenchyma.
- „ e, f. Spicules from the cortex.

Fig. 2. *Lobophytum hedleyi*, sp. nov.

- „ a. Colony. $\frac{1}{2}$ Nat. size.
- „ b. Portion of colony. Nat. size.
- „ c, d, e, f. Spicules from the cœnenchýma.
- „ g, h. Spicules from the cortex.



1a.



1e.



1b.



1f.



1c.



1d.



2c.



2a.



2d.



2h.



2b.



2g.



2f.



2e.

EXPLANATION OF PLATE XI.

Fig. 3. *Lobophytum tuberculosum*, Q. & G.

„ a, b, c. Spicules from the cœnenchyma.

„ d, e, f. Spicules from the cortex.

Fig. 4. *Lobophytum densum*, sp nov.

„ a. Colony. $\frac{1}{2}$ Nat. size.

„ b. Portion of colony. Nat. size.

„ c, d, e, f. Spicules from the cœnenchyma.

„ g, h. Spicules from the cortex.

Fig. 5. *Lobophytum confertum*, Dana.

„ a, b, c. Spicules from the cœnenchyma.

„ d, e. Spicules from the cortex.



3a.



3d.



3b.



3e.



3f.



3c.



4e.



4c.



4a.



4f.



4b.



4d.



4g.



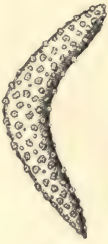
4h.



5a.



5d.



5b.



5e.



5c.

EXPLANATION OF PLATE XII.

Fig. 6. *Lobularia viride*, Q. & G.

! „ 6a, 6b, 6c, 6d. Spicules from the coenenchyma.

Fig. 7. *Spongodes pallida*, sp. nov.

„ 7a. Colony. Twice nat. size.

„ 7b. Portion of colony greatly enlarged.

„ 7c. Cortical spicule.

Fig. 8. *Siphonogorgia macrospina*, sp. nov.

„ 8a. Portion of colony. Nat. size.

„ 8b. Portion of colony. Greatly enlarged.

„ 8c. Rods from the canal walls.

„ 8d. Cortical spicule.



6 a.



6.c.



6.d.



6.b



7a



7. c.



7 b



8.d.



8 a.



8.b.



8. c.

THE ETHNOLOGY OF FUNAFUTI.

By CHARLES HEDLEY,

Conchologist, Australian Museum.

THE ETHNOLOGY OF FUNAFUTI.

BY C. HEDLEY, Conchologist.

INTRODUCTION.

MUCH of the information conveyed in the "General Account" could have been included with equal appropriateness in the present chapter; to it the reader is therefore referred for details not here repeated.*

The natives of the Ellice Group appear to be closely allied to those of the Phoenix and Union Groups, and also to those of several small outlying islands,† and atolls in the same neighbourhood, extending perhaps as far as Rotumah and Fotuna. This branch of the Polynesian Race may, for want of a better comprehensive term, be called the Tokelau People.

We are much in want of a satisfactory subdivision of the Polynesian Race. The only classification with which I am acquainted is that of Dr. H. Stolpe,‡ based upon ornamental art. Good though this undoubtedly is, yet a broader basis including physique, language, religion, and so on, is required for a sound arrangement. Dr. Stolpe throws the branch here proposed to be called Tokelau into his Province of Tonga-Samoa, from the remainder of which I would clearly distinguish it by, *inter alia*, the different gods they worshipped and the difference of tattoo.

The Tokelau People are closely related to the Samoans, whose standard of civilisation is, however, far superior. Either therefore, they have degenerated, as is probable, amid unfavourable surroundings or they branched from the parent stock before the latter reached the degree of superiority they afterwards attained.

Glancing for an instant further afield, I would draw attention to many points of resemblance between the Japanese§ and Polynesians that have occurred to me; such are their graceful courtesies

* For an article "The Legendary History of Funafuti," by Prof. W. J. Sollas, see *Nature*, 11 Feb., 1897.

† Compare the account given of Fotuna or Horne Island.—*Journ. Polyn. Soc.* i., 1892, pp. 33–52; of "Rotuma and the Rotumans," *Rev. W. Allen*.—*Proc. Aust. Assoc. Adv. Sci.*, 1895, (1896) p. 569; and Lister, "Notes on the Natives of Fakaofu."—*Journ. Anthropol. Inst.* xxi., 1892, p. 43.

‡ *Trans. Rochdale Lit. and Sci. Soc.*, iii. 1893, p. 73.

§ Polynesian relations to the Corea are noted by Stair.—*Journ. Polyn. Soc.*, iv., 1895, p. 55.

in peace and fierceness in war, the status and freedom of their women, the position and authority of their chiefs, the existence of a court language, their dexterity and daring in navigation and deep sea fishing, and their skill in tatooing and in manufacturing bark cloth or paper. In all of which features they are opposed to the Melanesians. To institute closer comparisons between the language, manners, customs and implements of the two races is an inviting task, which opportunity does not permit me to pursue, but I would submit it as a problem worth investigation, whether the Polynesians may not stand in the same relation of distant and degenerate kin to the Japanese as the Australian Blacks are known to hold towards the Indian Dravidians.

Since the above idea occurred to me I have perused with pleasure and profit an article by Mr. A. H. Keane, "On the Relations of the Indo-Chinese and Inter-Oceanic Races and Languages,"* This writer points out that "for science, there is no organic Malay type, Malay being a national not a racial designation." Other writers† have shown that the Japanese of to-day is likewise a fusion of several distinct stocks. Keane's view that the Polynesian of the Pacific represents an ancestral type now obliterated almost or altogether as a pure race in South East Asia, but still there discernable as a component element in existing people, has much to recommend it.

The route of the Polynesian from South East Asia to his present abode is generally held‡ to have been through Papua, south-eastwards through the larger islands of the western Pacific, by Fiji to Samoa, thence to Rarotonga and finally to Hawaii. Against this it seems to me an insuperable objection that the Samoans and Eastern Polynesians were without any Papuan strain physically, and had acquired none of the Papuan manners and customs, such as the art of pottery, which a transit through Papuan lands could not fail to impress upon them. Besides, at the point of contact between the two races, we now see a contrary wave of Polynesian blood and influence actually in motion from east to west. In the Fijian Archipelago there is a gradual transition from a preponderance of Polynesian in the east to a preponderance of Melanesian in the west. Less marked but perceptible is the change in the New Hebrides, and in the Solomons it can again be faintly seen, while New Caledonia furthest west appears purest Melanesian. Even in the east of New Guinea, Polynesian influence is traceable though here once more it declines westward. That such authorities as Wyatt Gill and Percy Smith should derive the Maories from an eastern source—the Hervey and Society Groups—accords better with the following hypothesis than with the accepted theory. Ellis

* Journ. Anthrop. Inst., ix., 1880, p. 254.

† Griffis—The Mikado's Empire, 1887, p. 27.

‡ Rankin—Journ. Anthrop. Inst., vi., 1877, p. 233.

regarded the Tahitian as an offspring of the Hawaiian stock, the longer genealogies of the latter indicating superior antiquity.*

Had the Polynesian migration taken the route usually ascribed to it, why should not its influence have been as strongly impressed on the west as it is on the east of the Melanesian tribes; why should that influence rapidly increase eastward, and above all why should the brown man, while leaving his mark on the susceptible black, yet have entirely escaped reciprocal treatment?

An alternative hypothesis, which would avoid these objections but which does not appear to have been examined, is that the Polynesian travelled from Asia, first to the Hawaiian Group† and after, perhaps, considerable sojourn there, migrated to Tahiti and thence to Samoa.

Physique, language and tradition alike point to Samoa as the immediate ancestral home of the Tokelau People. Estimated by the chronological standard of European history it is possible that this archipelago has been but recently colonised.

Pritchard relates a tradition of Vaitupu, which places the arrival of the first comers at seventeen generations back.‡

Communication with the Gilbert Islands to the north probably wrought in the life of the Ellice Islanders a change comparable with the later change induced by European contact. A social revolution must have been effected by the acclimatisation of the coconut alone, involving as it did the introduction of the Gilbert Island system of land tenure.§ The tattoo patterns certainly followed the same route, and doubtless various social and religious practices accompanied these.

* Ellis—Polynesian Researches, i., 1832, p. 123.

† Two suggestive facts may here be mentioned; one is that Hillebrand considers the *Broussonetia* or tappa plant, the most peculiar possession of the Polynesian, to be a native of Japan; the other that Japanese junks have drifted to Hawaii with occupants still living.

‡ Pritchard—Polynesian Reminiscences, 1866, p. 403. Of the Gilbert Group, Wilkes wrote:—That the islands have been peopled within a period not very remote is believed by the natives themselves" (*loc. cit.*, v. p. 86). Kotzebue considered with regard to Romanzoff Atoll in the Marshall Group, that, "all the islands had been but lately inhabited," (*Voy. Discovery ii.*, 1821, p. 45). And Gill declared that, "The result of my researches is the belief that the Hervey Islands have been inhabited not more than six centuries," (*Journ. Anthropol. Inst vi.*, 1877, p. 7). It is stated (*ante* p. 61) that the presence of phosphate in the gardens is inexplicable to me. Dr. Guppy's observations on the Keeling Islands (*Scot. Geogr. Mag.*, v., 1889, p. 292) have now made it clear to me that this phosphate is a relic of the bird guano deposited before the arrival of man. If the rate at which these phosphates disappear could be ascertained, data would be available for calculating the time the islet has been inhabited. On Cocos Keeling half a century had reduced it to a trace.

§ Compare the account on p. 61 *ante* with *Journ. Polyn. Soc.*, i., p. 266 and with Wilkes—*U.S. Explor. Exped.*, v., Chap. III.

Funafuti is for many reasons an unfavourable centre for Ethnological research. In weeding out the so-called immoral practices of heathen days, the missionary agents seem, to a casual onlooker, to crush out many innocent recreations, uprooting the wheat and the tares together. The trader, another civilising influence, does his part by substituting European wares for native products. But the greatest shock the native civilisation suffered was when the South American raiders almost depopulated the atoll thirty years ago.* The place of the expatriated natives was largely taken by immigrants from other islands.

On glancing over the ground covered by the following paper my predominant impressions are: firstly, the poverty of our knowledge of Polynesian Ethnology and the superficial way in which it has been studied; and secondly, the rapidity with which the knowledge of it that might yet be gathered is vanishing. Though in a library catalogue the bulk of Polynesian literature appears large, yet when consulted upon trivial points it rarely responds satisfactorily. Travellers seem to have contented themselves with observing and collecting only the most obvious incidents and articles. "If investigators and students would seize upon those features in social life—form of etiquette, games, ceremonies, and other manners and customs—which are the first to change in any contact with alien race, a very important work would be accomplished for the future sociologist."†

Although I have constantly appealed to, and derived much help from Edge-Partington's valuable Ethnographical Album, yet I am compelled to say that, without confirmation, the use or locality of any implement he figures, dependent as he often was on second-hand information, cannot be trusted; indeed the long list of corrections he supplies, are to a thoughtful reader a sufficient warning.

The following remarks of Professor Haddon cannot but receive the heartiest endorsement of all interested in this study. "Only those who have a personal acquaintance with Oceana, or those who have carefully followed the recent literature of the subject, can have an idea of the pressing need there is for prompt action.

* The blackest pages in the story of the South Sea Islands are those describing the Peruvian piracies. Twenty-five vessels were fitted out in Callao for the purpose of procuring ten thousand Polynesians for forced labour in Peru. The densely peopled and more warlike islands of the west were avoided, but the gentler people of the mid Pacific were deceived and deported wholesale, one instance of which is related on p. 5. Early in 1863 about 2000 Polynesians were captured, transferred to a depôt on Easter Island, and ultimately forwarded to South America. Unaccustomed to hard and continuous labour these unhappy victims soon perished. Among other groups the Tahitian was raided, but the French, in whose dominion those islands were, not only captured six vessels and punished the slavers, but took measures to prevent a repetition of the offence. An account of the affair is given in the *Sydney Morning Herald* of June 20th, 1863.

† Morse—Japanese Homes, 1888, p. 8.

In many islands the natives are fast dying out, and in more they have become so modified by contact with the white man and by crossings due to deportations by Europeans, that immediate steps are necessary to record the anthropological data that remain.”*

In writing down native names an endeavour has been made to follow the system of orthography adopted by the Royal Geographical Society, in which the vowels are pronounced as in Italian and the consonants as in English. How loose the natives themselves are in their pronunciation and how difficult it therefore is to decide upon a correct spelling, only travellers are aware.

The terms—Polynesian, Micronesian and Melanesian—have such different values in the writings of different authors that it is necessary to state that in subsequent pages they are used in the meaning imposed upon them by Whitmee.†

For a valuable contribution to this section I am again indebted to the kindness of Surgeon F. W. Collingwood, R.N., late of H.M.S. “Penguin.” To the skilful pen and sympathetic courtesy of my friend Mr. Norman Hardy, I owe the drawings of the native using the coconut scraper and the man putting on his “tukai” dress. For the remainder of the illustrations I am myself responsible.

Any merit which the following descriptions of implements (essays in an unfamiliar field of research) may possess, is due to the advantage of a course of study of Australian weapons and implements, under Mr. R. Etheridge, Junr., whose advice and suggestions have constantly aided me in the preparation of the present paper.

ANTHROPOLOGICAL MEASUREMENTS.

By the extreme courtesy of Surgeon F. W. Collingwood, R.N. of H.M.S. “Penguin,” whose observations enriched some of my earlier pages I am enabled to incorporate in this article a series of measurements of adult males. The plan of the measurements is that recommended by Dr. John Beddoe, F.R.S., in the “Notes and Queries on Anthropology for the use of Travellers and Residents in Uncivilised Lands,” 1874, which were drawn up by a committee appointed by the British Association for the Advancement of Science. I need hardly point out that the fact of these measurements having been taken by an experienced medical officer much enhances their value.

The subject *A* was a native of Funafuti, aged 26, no wisdom teeth, dentition otherwise perfect; *B*, a native of Funafuti, aged 28, nose straight, slightly flat, lobe of the ear rudimentary, all

* Haddon—*Nature*, 28 Jan., 1897, p. 306.

† Journ. Anthrop. Inst., viii., 1879, pp. 261–274, and map; these definitions have since been accepted by the *Encyclopædia Britannica*, *Stanford's Compendium of Geography*, the *Godeffroy Museum Catalogue*, and other standard works.

wisdom teeth cut, decayed dentition, right upper central incisor, right lower first molar slight, left upper central incisor, first, second and third molar, and left lower, second, molar; *C*, a native of Funafuti, aged 20; *D*, a native of Funafuti, aged 18, afflicted with quinodarus in the left foot, the left leg having a maximum calf circumference of only 29 cm., wisdom teeth present, dentition perfect; *E*, a native of Funafuti, aged 50; *F*, a native of Funafuti, aged 24, intelligent, benevolent face, lobe of ear slight, wisdom teeth none, dentition perfect; *G*, a native of Funafuti, aged 28, no wisdom teeth, dentition perfect; *H*, a native of the neighbouring atoll of Vaitupu, aged 30, lobe of ear slight, teeth perfect, wisdom teeth all cut; *I*, a native of Nui, aged 24; *J*, a half-caste, mother a native of Funafuti, aged 20–21 years, angular chin, no marked lobe of ear, imperfect teeth, left lower, second and third molars.

Though the women predominated over the men almost in the proportion of three to two, it was not found possible to subject them to measurement.

Dr. Collingwood further notes that the islanders are a fine race of people, of good stature, long armed, with intelligent faces and good manners. The colour of the skin varies somewhat, of a dark fawn colour, the noses are somewhat flattened and broad, and they have moderately thick lips. The half-castes surpass, in many cases, the pure natives in strength, appearance, and their capability of fishing and other native employments. The women allow their hair, which is very black, luxuriant, wavy and sometimes distinctly curly, to grow fairly long. In one family of a mother and three children the hair was distinctly reddish-brown.

Of the series of coloured casts of faces of the South Sea Islanders published by Dr. Finsch of Bremen, one, No. 48, of an Ellice Islander does not strike me as a typical specimen. The colour seems to me too light and the forehead too sloping to be characteristic.

The long arms noticed by Lister* on Fakaafu equally characterise the natives of Funafuti. Wilkes calls attention to a singular attitude, which he illustrates, affected by a Funafuti native, who rested the sole of one foot on the knee of the opposite leg. How natural a posture this is can scarcely be appreciated by a wearer of boots and trousers. Collins and Lumholtz† have drawn Australian Aborigines in this position, and Lesueur‡ a Tasmanian. Mr. Hardy has photographed men at Simbo and at Samarai resting in this posture.

The following measurements are in centimetres.

* Lister—*Journ. Anthropol. Inst.*, xxi., 1892, p. 46.

† Collins—*English Colony in New South Wales*, 1804, pl. xvi.; Lumholtz—*Among Cannibals*, 1890, p. 77.

‡ Lesueur—*Voyage aux Terres Australes*, 1804, Atlas, pl. xv.

	A	B	C	D	E	F	G	H	I	J
Height from ground of vertex	160.3	172.2	167.9	163.8	158.5	171.8	175	165.8	166.5	169
" " of meatus auditorius (opening of ear)	146.2	158	...	...	145.5	...	...	151.25	153.6	157
Height from ground of chin	137.3	149	146.6	142.2	138.1	148	...	142	142	146.5
" " of top of sternum (breast bone)	131	143	137.6	137.1	129.4	141.6	145.8	134.6	137.5	134.4
" " of umbilicus	93.5	106.6	...	95.7	95.6	105	104.6	98.3	100.4	101
" " of upper part of trochanter (i.e. of point where upper end of thigh bone felt prominent under skin)	81.5	...	85.2	91	85	91.9	99.2	...	87	85
Height from ground of articulation of knee	48.2	...	...	49.1	47	52.7	56.3	47.2	49.3	49.3
" " of point of acromion (i.e. anterior point of shoulder, felt by carrying finger along collar bone to its outer extremity)	...	143.1	...	134.7	129.2	143	147.3	137.25	138	141
Height from ground of elbow	95.1	104.5	102.2	98.1	101	104.1	...	101	104.2	105.5
" " of point of midfinger (hanging vertically)	54	61.6	59.5	55.3	53	62.8	62.6	62.3	55.4	61.3
Height when sitting on the ground	...	91.2	87.3	83.2	77.5	85.2	88.1	89.1	83	88.8
The breadth of shoulders (i.e. between the acromia)	...	40	38	36.5	41.5	40	...	40.8	34	42
" " of haunches... ..	...	...	...	...	...	...	...	...	25	27
Circumference of chest at arm-pit	91	98.5	91	89.2	96	95	97.8	96	85	98
" " at nanna	92	99	91	92	97	95.8	99.5	98	84.6	98.2
" " of haunches	...	...	...	...	85.2	...	...	90	74	...
" " of trochanters	...	...	...	...	86.2	...	...	...	...	...
" " of neck	...	36	36	35.8	34.5	38	...	37	31	36
" " of waist	74	87	79.5	75.5	...	82.6	...	83.8	71	75
" " of calf, maximum	...	33	36.6	32.5	...	34.2	37	36	...	...
" " of arm, maximum	...	38	27.3	27.3	...	29.5	32	33	23	30.5
" " of forearm, maximum	...	30.2	...	27.5	...	29	28.5	31	25	28.8

	A	B	C	D	E	F	G	H	I	J
Span of outstretched arms	173	184.5	173.5	178	162	183	184.5	169.5	181	179
„ of thumb and midfinger	...	{ 18.2 22	...	18	...	16	18.5	17.5 sp.19.2	21	17 sp.21
Length of thumb, from second joint to tip	...	3.5	3.0	3.6	...	3.3	3.4	3.4	3.5	3.5
„ of foot	...	25	27	...	...	25.5	27.5	25.5	...	25
Greatest circumference of head from the glabella	...	56.5	57.4	57.7	54	57.3	58	57	53.8	55.5
Arc from notch at root of nose toinion	...	34.8	36	37.2	32	34.9	34.8	36.4	33.2	34
Arc from tragus to tragus over top of head	...	36.5	38	37	36	38	37	38	36.5	36
Arc from tragus to tragus over superciliary ridges and glabella	...	30.3	30.5	29.7	29	31.3	31.8	30	29	29
Greatest length from glabella backwards	19.3	17.9	18.7	19.5	18	18.6	19.4	19.1	18	18.2
„ „ from smooth spot immediately above glabella	19.3	17.8	18.8	19.8	18	18.5	19.4	18.85	17.5	18.2
Length from glabella toinion	19.45	18.1	18.2	19.4	17.2	18.5	19.4	18.85	17.5	18.2
Greatest breadth of head...	14.6	16.2	16	14.4	15	16	15.7	15.5	14.8	15.6
Greatest breadth of zygomatica	13.6	14.2	14.4	13.8	13	14.6	14.25	14.1	13.7	13.7
Breadth from tragus to tragus	13.2	13.2	13.7	13.2	13.5	13.6	13.6	13.3	13	13.9
Least frontal breadth	12.2	12.7	12.8	11.8	12	12.7	12.3	12	11.8	12.6
Length of face, root of nose to lower border of chin...	11.2	12.2	11.05	11.3	12	10.4	11.35	12.2	12	11.3
Greatest length of head from chin up and backwards	25.4	25	25.4	25.9	25	25.5	25.2	25.5	25	24.5
Height of head from meatus auditorious to vertex	13.7	14.4	14.6	14.7	14	14.5	14.8	14.45	14.2	13.8
Distance from tragus to junction of nose and upper lip in middle line	12.2	12.2	12.2	12.4	12.2	12.2	12.4	11.6	12.4	12
Distance from tragus to smooth spot immediately above glabella	12.4	12.2	12.9	12.9	12.5	13	14	12.5	12.3	12.75
Distance from said spot to junction of nose and lip	8	7.8	8.1	8.6	6	7.8	8	7.9	8.05	7.8
Breadth of nose	4.6	4.1	4.0	4.0	...	4.4	4.4	...	...	3.7
Breadth of lips conjoined	1.5	2	2	2	...	...	...	...	...	1.9

TATOOING.

In their tatooing the Ellice Islanders differed greatly, as the American Exploring Expedition remarked, from other branches of the Polynesian Race, both in their patterns and in the sharing of the custom by both sexes. As far as I can gather, the Micronesians, whose figures resemble more those of Funafuti, use short straight lines variously arranged in chevrons, diamonds, etc.,* whereas the tatooing of the Polynesians, at least as shown by the Maories, seems rather to have been disposed in curves, employing spirals, scrolls, and circles.† Again, among the Polynesians it was the rule to tatoo men profusely, women slightly or not at all; a rule reversed by the Melanesians.‡ In Funafuti both sexes were of old equally tatooed.

Tatooing has long been an extinct art on Funafuti, and I was unable to procure any of the implements used in it. Only half-a-dozen, old, white-haired men and women survive who are thus decorated.

Of the Funafuti men, one of whom he figured, Wilkes wrote:—"They were tatooed differently from any heretofore seen, their arms being covered, from the shoulder to the wrist, with small curved figures or zig-zag lines. They had this tatooing also on the body, extending from the armpits to the waist, and down, until the whole body was encompassed in the same manner. No marks were observed on the face or legs, but on two of them were a few lines across the small of the back." And of the Nukufetau men the same author continues:—"The tatooing was in great variety on the body, but in all, the arms were tatooed alike, for there it varied only in quantity. On the body it was frequently extended across the back and to the abdomen; and in many, the bodies and thighs were tatooed down as far as the knee. Many of the natives designated the figures as intended to represent pigeons." On the men of Atafu, the same traveller saw, "many marks resembling fish on the arms, and a sort of triangle, together with figures of turtles, on the breast." On Funafuti a native of Nanomea explained to me that certain tatoo marks on his arms represented *Holothuria*.

Only one woman from Nukufetau visited the "Peacock." "Her arms were beautifully tatooed, of the same figure as the men, but the tatooing was continued down the leg in horizontal stripes an

* For tatooing of the Caroline Islanders see Kubary—Journ. Godeffroy Museum, vii., 1875, p. 129; for the Marshalls, Kotezbue—Voyage of Discovery, ii., 1821, plate facing p. 63; for the Gilberts, Wilkes—*op. cit.*, v., p. 77; for Rarotonga, Williams—Native Missionary Enterprises, 1837, p. 503.

† Robley—Moko, or Maori tatooing, 1896.

‡ Turner—Samoa, 1884, p. 55.

inch and a half wide. This constituted a great difference from the Polynesians, for with them we have never before met with any females who were tatooed, excepting a few marks on the fingers and feet."

All I could learn of the manner of tatooing on Funafuti was that it was performed with a sharpened bird-bone tapped into the skin with a mallet; the pigment used was *Hernandia* nut reduced to charcoal, ground, and mixed with water. Except the pigment, it is probable that the mode of tatooing differed little from that in general use throughout the Pacific. The instruments and their use are thus described by a surgeon who endured a tatooing in the Marquesas:—"Eight or ten candlenuts are strung on a piece of reed, which is stuck in the ground, the upper one being lighted. An inverted section of a coconut is suspended over it. This condenses the smoke, which is very black, and when mixed with a little water, forms the marking-ink. The marginal lines of any figure are first marked out with a very small stick, the remainder is executed without a guide. The instruments for inserting the colouring matter into the skin are made of pieces of bone made flat, and serrated at one end, like either a comb or saw. The breadth of this end differs from the eighth of an inch to one inch, according to variety or minuteness of work, some having only two teeth, some a dozen. The other end is brought to a blunt point, and inserted at right angles into a small cane about six or eight inches long. The piece of cane is held between the finger and thumb of the left hand. The stick for beating this into the flesh is long or short, according to the fancy of the operator. The hitting of the stick is so very rapid that it resembles nothing that I know of more accurately than a trunk maker driving his nails."*

The original pigment of the Polynesian seems to have been the soot of the candlenut fruit, *Aleurites triloba*; where the race wandered beyond the habitat of that tree, substitutes had to be found. In Funafuti *Hernandia* was used, and in New Zealand, Robley tells us that *Dammara* gum, *Podocarpus*, *Veronica*, and the vegetable caterpillar *Cordiceps larvarum* were employed.

In Funafuti both men and women were tatooed with the same pattern, which was peculiar to the atoll, and distinguished them from other islanders.

* Coulter—Adventures in the Pacific, 1845, p. 210. The operation is also described by Pritchard—Polynesian Reminiscences, p. 143; by Turner—Samoa, p. 88; by Polack—Manners and Customs of the New Zealanders, ii., 1840, pp. 42-51; by Robley—Moko, 1896, p. 56; by Guppy—Solomon Islands, 1887, p. 135; by Buckland—Journ. Anthropol. Inst., xvii., 1888, p. 318.

The subject I examined, Sami, an old white-haired man, was one of the few tatooed survivors. The tatooing (figs. 1, 2, and 3),

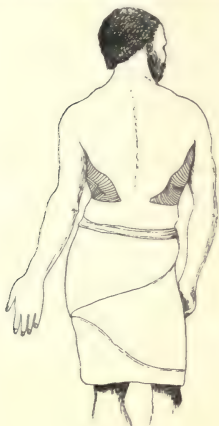


Fig. 1.



Fig. 2.

was confined to the smooth inner surfaces of the arms and the sides of the body, so that when he faced me "at attention" with the arms close to the trunk, his tatooing was scarcely visible. The arms were tatooed from three inches above the wrist to two inches below the armpit. On the back the tatooed areas extended in triangles from a point in the lumbar region, two inches from the spine, upwards to the armpit and horizontally round the waist. The pattern is carried under the arm to a point in front an inch beneath the nipple of the breast, then vertically downwards till a right angle is formed by the junction of the waist-line.

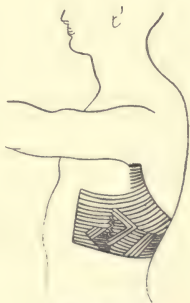


Fig. 3.

DRESS.

The old-fashioned kilt dress of Polynesia is still made and used on Funafuti. It is, however, like most native articles, in process of decadence, being only worn by the poorer people or by those

engaged in rough work meaning to save more valued clothes. The Tahitian "tiputa" has been imposed by the mission upon the women; both sexes wear the Fijian "lava lava" of European calico, another modern innovation. For state occasions the men wear shirt and trousers, and the women loose gowns in which they each appear awkward and uneasy. I did not learn that tappa cloth was made on the atoll.

THE TUKAI.

The ancient masculine costume, the "tukai," is well shown by the figure given by Wilkes* of the Funafuti native wearing one, which is described as "a strip of fine matting made of the pandanus leaf, about eight inches wide and ten feet long, and fringed on each side." On Nukufetau the same Expedition saw pandanus mats "worn as a girdle of thick fringe, from eight inches to a foot broad, tied about the loins so as to cover in part the maro: to this they gave the name of 'takai'; the last was used as a wrapper about the body and legs."

Edge-Partington figures† this garment as from Rotumah, describing it as now obsolete.

Whereas the "titi" was simply tied round the waist, the tukai was first passed between the limbs and then around the body. From the accompanying sketch (Plate xiii.) of a man putting on his tukai it will be obvious that although this dress has acquired a secondary resemblance to the titi, it is really homologous with the T bandage formerly worn by the inhabitants of the neighbouring atolls of Atafu and Fakaafu.‡

The tukai primarily consists of a long narrow mat with a fringe of unwoven strands. Comparing the dress as it appeared to me on Funafuti with the drawings of Wilkes and Edge-Partington, it will be noticed that the fringe in the modern specimens I procured, has greatly broadened, while the total length of the dress has decreased to nearly half. I am unable from the specimens and illustrations at my disposal to trace all the gradations between the ordinary form of the T bandage and the tukai, but I feel convinced of their existence.

A specimen (fig. 4) of a highly ornate dance tukai, made for me on Funafuti, weighs two pounds four ounces, is six feet six

* Wilkes—*op. cit.*, v., p. 41.

† Edge-Partington—*loc. cit.*, ii., pl. li., fig. 4.

‡ Wilkes—*loc. cit.*, v., plate facing p. 3 and p. 36; this loin cloth is also the ordinary masculine dress in the Solomons, as shown in Guppy's Solomon Islands, plate facing p. 102; and in Eastern British New Guinea, for example, Finsch—*Ethnological Atlas*, pl. xvi., and Lindt—*Picturesque New Guinea*, pl. xli.; the most reduced form of which known to me is the string "sihi" of the Motu, exemplified by Lindt, *op. cit.*, pl. xxxiv., the man on the left.

inches in total length, and when folded for use is eighteen inches in depth, it is made of the inner bark of the fau (*Hibiscus tiliaceus*)



Fig. 4.

stained red with nonou (*Morinda citrifolia*). When unfolded, the centre band (fig. 5) is four and a half inches wide, woven closely of narrow strands; along the outside edge of the matting is a seam where additional fibres have been introduced to lengthen and thicken the dress: this latter feature is absent from an old, worn and unornamented tukai in the collection.

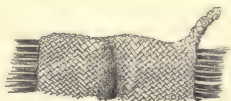


Fig. 5.

At the inner corners the matting is produced into plaited strings for tying on the dress. The outer part of the fringe, that which is exposed when worn, is elaborately decorated with pandanus leaf ribbons arranged in four series of four, whose symmetry is only broken by the substitution of red for yellow in the penultimate one. Each ribbon is attached to the lower edge of the matting, is two feet long, two to two and a half inches wide, and forked at the tip. The right-hand streamer is for half its length decorated with three series of successive breadths of yellow, red, and black leaf, sewn on with European cotton. A row of five or six white tests of a Foraminifer (*Orbitolites complanata*, var. *laciniata*), is sewn on each black band. The second ribbon is yellow, with one red band atop; the third is black with a black and a red fold above, thence a series of confluent yellow diamonds extends to the edge of the fringe; the fourth is wholly red; the fifth repeats the first, and so on. This style of ornament recalls that of a Banks Island robe, figured by Edge-Partington.* When the dress is put away these ribbons are carefully doubled up and tied to be out of harm's way. The native Wilkes figured was similarly decorated with pandanus ribbons, but as far as I can understand his description they were attached not to the tukai but to a separate belt. From Tahiti, Edge-Partington figures a like girdle with pendant tassels,† and in the New Hebrides there exists a similar overall dress with streamers five or six feet long.

* Edge-Partington—*loc. cit.*, ii., pl. lxxxv., fig. 8.

† Edge-Partington—*loc. cit.*, i., pl. xxxv.

Another ornate tukai was decorated with less elaboration than the one described. In place of the discs of Foraminifera, white feathers were used.

A third tukai, intended perhaps for every-day wear, was of the same dimensions but quite plain.

THE TITI.

The "titi" or woman's dress appears in Funafuti in a form common alike to Melanesians and Polynesians, and extending over a wide area of the South Pacific. The name of it suggests a derivation from the Ti tree (*Cordyline*) whose handsome, elliptical leaves tied by their stalks in a belt are in some islands still used as a temporary or hastily made dress, and which may have been the earliest form of the garment.*

In making the titi, a woman arranges her material, usually dressed leaves of pandanus or coconut palm, in convenient heaps. For the waist-band is selected a double cord of two or three ply coconut fibre, one end of which is made fast to a post of the hut the other being attached to the operator's waist. Sitting on the floor, the workwoman draws from the heap two handfuls of fibre, one she doubles over the cords, the other she knots across and



Fig. 6.



Fig. 7.



Fig. 8.

between them, as shown diagrammatically by fig. 6. A continuation of this process (fig. 7) completes the dress.† The leaves may afterwards be combed into finer strands by the "tosi." At one end the waist-band terminates in a loop, at the other in two strings with which it is tied at the side of the wearer.

Ornamental dance dresses differ from ordinary ones by the addition of extra flounces, etc. A specimen of the former now before me (fig. 8) weighs four pounds six ounces and measures three feet in length and twenty-one inches in depth.

* Guppy—*loc. cit.*, p. 130; and Turner—*loc. cit.*, p. 118.

† Elsewhere in the Pacific other modes of knotting the fibres to the belt exist. That none of these have been described is a surprising instance of the superficialness of our knowledge of Polynesian Ethnology. Here lies a field for cultivation at once easy and prolific. A Papuan pattern, very distinct from that described in the text, will shortly be described in the Proc. Linn. Soc. N.S. Wales for 1897.

It is variegated by the intercalation of a brown coconut leaf flounce between two of white pandanus leaf, and is also adorned by four series of three coloured pandanus ribbons and decorated by the black feathers of the Frigate bird.

Plain dresses from the coconut leaf and from pandanus are also represented in the collection.

The only Ellice female seen by the American Exploring Expedition was a Nukufetau woman, who "wore a cincture around her waist, and a mat over her bosom. The cincture was made of pandanus leaves; this was fastened to a cord as a thick fringe, two feet in length, and extended to her knees."

When a dress has been laid aside for a while it is fumigated as described (*ante* p. 102) to rid it of noxious insects.

The grass rain-cloak of Japan has a general resemblance to the Polynesian titi. The Micronesian loom appeared unknown on Funafuti.

SANDALS.

A common article of apparel, widespread through the Pacific and still in daily use, is the sandal, on which scanty attention has been bestowed by Ethnologists.

Under the title of "Sandal used when fishing on a reef," Edge-Partington illustrates a type slightly differing from that we are approaching.* His statement is confirmed by a veteran missionary, my friend the Rev. George Brown, LL.D., who tells me that the sandal is thus worn in Samoa.

The Rev. W. W. Gill writes of Mangaiia:—"At the top, the 'ungakoa,'† is protected against attack by a dense shield, whilst the circular edge of the cavity is as keen as the edge of a razor. This animal grows with the bed of coral, the long cavity becoming increasingly large. Young 'ungakoa,' like young oysters, are easily detached from the coral by means of a hammer. Children eat them raw, not forgetting a supply of cooked taro out of their tiny baskets. Hence the necessity of using sandals for the protection of the feet; woe betides the luckless wight who should tread with his entire weight upon one of these 'cobbler's awls.' Round pieces of flesh are in this way scooped out of the foot."‡

Another reference to this article occurs in a native address given by Gill:—"I now carefully turn my sandals, so that both sides may be equally worn, pick up my basket and fishing tackle, and go to the outer edge of the reef to angle."§ From Tahiti, the sandal is described by Ellis.||

* *Loc. cit.*, i., pl. lxxvii., fig. 7, from Samoa; and pl. clxxvii., fig. 5, from Mortlock.

† Probably *Vermetus maximus*, Sowerby.

‡ Gill—*Savage Life in Polynesia*, 1880, p. 114.

§ Gill—*Life in the Southern Isles*, 1876, p. 145.

|| Ellis—*Polynesian Researches*, i., 1832, p. 143.

In the Museum at Honolulu there are deposited, "Sandals for walking on coral reefs," from Santa Cruz. The sandals of the ancient Hawaiian could hardly be called a regular part of the national costume, as they were only worn to protect the feet in journeys over the rough lava beds. The sandals, "malina," were simply braided cushions attached by cords, often of the same material, over the toes and around the ankle. Another allusion to these sandals terms them "kama waoke."*

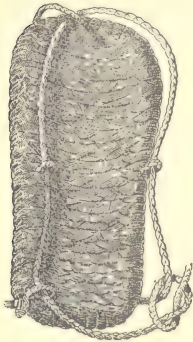


Fig. 9.

of the loops. The sandal is put on (fig. 10), by thrusting the second and third toes through the largest loop, applying the pad to the sole of the foot, drawing the cord tight and fastening it round the ankle. When fitted, both heel and toe overlap the pad. The construction of the Samoan sandal suggests that it is worn in a slightly different manner.



Fig. 10.

Webster, ascending Mauna Loa in 1851 observed that his native guide Sam, "always careful of number one, had provided himself with sandals made from the fibre of coconut husk" to save his feet from the sharp lava.†

The sandal "tukka" is still employed at Funafuti, whose fishermen are thus shod when wading on the reefs. A pair before me, of which one is represented by fig. 9, weighs five ounces. Each is eight inches long, four wide, and nearly one thick. Upon an oval, rope foundation, flat sinnet is woven under and over; at the toe end there is a long loop, at each side two short ones, and, at one corner of the heel end, a fourth loop. From the opposite corner of the heel end arises a flat cord thirty-nine inches long which is rove through each

The Japanese have a sandal closely resembling this, but the "kuditcha" shoes‡ of Australia are too distant in use and construction to require comparison.

* Brigham—*loc. cit.*, pt. ii., p. 87; pt. iii., pp. 21 and 61.

† Webster—*Last Cruise of the Wanderer*, n.d., p. 18.

‡ R. Etheridge, Junr.—*Proc. Linn. Soc. N.S.W.* (2) ix., 1895, p. 544; Favenc—*The Moccasins of Silence*, n.d., frontispiece; Edge-Partington—*loc. cit.*, ii., pl. ccviii., figs. 7, 8.

EYE-SHADE.

The skill of the Polynesians in plaiting has already been shown by various articles discussed in this essay, and this aptitude is further exemplified by their eye-shades. In the case of this object I am beset by the usual difficulty encountered in the study of the lesser possessions of the Polynesians. Consequent on few writers having descended to the notice of such apparent trifles, there are but scanty records available of variation or of geographical distribution.

The Polynesian eye-shade appears to have been adopted by the Melanesians, for Edge-Partington pictures it from Papua,* and it is frequently recorded from the Solomons. Dr. H. B. Guppy observed that "sunshades in the form of a peak of plaited grass bound to the forehead and projecting over the eyes are occasionally worn by the natives of Bougainville Straits, whilst fishing in canoes, in order to protect their eyes from the sun's glare on the water. In Ugi, these sun-shades are sometimes worn on gala days. They did not, however, appear to be in constant use in any part of the group which we visited." This account is illustrated by a photograph of "Men of Ugi wearing sun-shades."† Woodford pictures a Rubiana native wearing one.‡ From Savo there is a specimen in the Australian Museum, and Edge-Partington figures others from Ysabel and San Christoval.§

Wilkes shows some of the individuals of a group of Fakaafu natives wearing the eye-shade, and at Atafu the men wore "on their head a piece, made in some cases of matting, in others of tortoiseshell, and occasionally this ornament resembled an eye-shade, or the front of a cap, to protect the face from the sun."|| A sketch by Webber, in the British Museum, is reproduced by Edge-Partington, showing Tahitian women making bark cloth, two of the figures in which are wearing sun-shades. "A sun-shade from Tahiti made of finely plaited coconut fibre" is also drawn separately.¶ "Here, says Ellis, it is called 'taupoo,' or 'taumata.'""**

The eye-shade of Funafuti, "mataili," was only used when line fishing from a canoe. It was plaited indifferently from coconut palm frond or pandanus leaf, was thrown away at the end of the day's work and made anew as wanted. The specimens that I have examined of the eye-shades of the Solomon natives are all of coconut frond, they differ from the Ellice Island pattern in having

* Edge-Partington—*loc. cit.*, i., pl. cccvii., fig. 6 and pl. ccexxv., fig. 4; see also: Ratzel—*The History of Mankind* (English ed.) i., 1896, plate facing p. 214, fig. 15, and p. 224.

† Guppy—*loc. cit.*, p. 139, and pl. facing p. 102.

‡ Woodford—*A Naturalist among the Head-hunters*, 1890, p. 150.

§ Edge-Partington—*loc. cit.*, i., pl. cci., fig. 4, and ii., pl. cvii., figs. 7, 8.

|| Wilkes—*loc. cit.*, v., pp. 6 and 36.

¶ Edge-Partington—*loc. cit.*, i., pl. xxxi. and pl. xxxiii., fig. 5.

** Ellis—*loc. cit.*, ii., p. 399.

the loop, which passes round the back of the head, made in one piece instead of being in two strings knotted together; also in having the front margin projecting into horns at the corners, which Mr. N. Hardy suggests to me are ornamental representations of the wings of Frigate Birds. On some of the other atolls of the group, Mr. O'Brien tells me that small pouches for the reception of fish-hooks, etc., were made on the under surface of the flap. On Funafuti the natives had a trick of thrusting such sundries as a stick of trade tobacco into the plaits of their eye-shades.

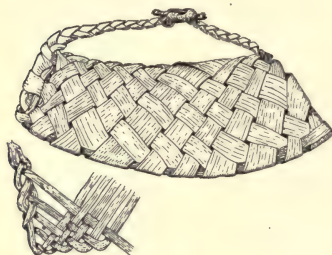


Fig. 11.

Two specimens of the eye-shade from Funafuti present themselves for description. Both are of woven pandanus leaf; the larger shown in fig. 11 is fifteen inches ounce and a quarter, by six, and weighs an it is coarsely plaited, of about nine, broad, diagonal pandanus strands, an inch or an inch and a half wide; from the inner margin the strands are carried in a band

and knotted at the back of the head, so as to form a loop about a foot long. The smaller example is about twelve by four and a half inches, of finer pandanus strands, there being about thirty rows of quarter inch plaits; the weight of it is half an ounce. The smaller figure is a sketch, taken on the spot, of a palm frond tip which I saw a native in process of weaving into an eye-shade.

ORNAMENTS.

Trinkets for personal adornment, except those of European pattern, are now, through missionary influence, disused on Funafuti. A band of small and polished Nautilus shells, somewhat like that Edge-Partington figures from Samoa,* was purchased by a member of the Expedition. As the Pearly Nautilus does not occur alive on the atoll, and rarely if ever drifts there, I am not satisfied of the local origin of that ornament.

On Nukulailai I found shell necklaces in fashion. One I purchased called "pouli," weighs an ounce and a half and measures sixteen inches in length, and was composed of a hundred and seven bleached and yellow shells of *Melampus luteus*, each pierced near its anterior extremity, and strung either backwards

* Edge-Partington—*loc. cit.*, pl. lxxxvi., fig. 2.

or forwards, alternately left and right, on a cord plaited of four strands (fig. 12). In estimating the beauty of such a necklace, it should be remembered that it is designed not to contrast with a white skin, where its effect would be displeasing, but against a brown one, where it is in chromatic harmony.



Fig. 12.

Models were made for me on Funafuti of a pair of dance ornaments, "lilima," (fig. 13) such as were worn in "the old days." Each



Fig. 13.

armlet is composed of three pandanus leaf ribbons, two feet long, super-imposed one upon another, except above, where the lower projects beyond the upper. The uppermost is reddened with nonou, the second blackened with tar, and the third retains its natural yellow. The red leaf is crinkled* with transverse creases an inch and a half apart. Near the upper end the leaves are gathered with a bow of ornamental cord, on which is strung a button of white shell, *Natica mamilla*; the ribbons are further surmounted by a tuft of palm pinnules upon which is arranged a fold of the bow of the cord. The cord is segmented black and yellow, consisting of a strand of human hair laid up with a strand of bark thread.† The whole has a tasteful effect. It was worn, said the maker, by tying the strings round the biceps of the arm.

Head-dresses were formerly made of the Frigate bird plumes,‡ but of these I failed to procure either specimens or models. A pandanus leaf head-dress is figured by Wilkes, the Funafuti native wearing it also sports an ankle-ring.§

On Nukufetau the American Exploring Expedition observed a coconut leaflet tied round the necks of some men (*ante* p. 27). On Fotuna this was a mark of rank.|| An illustration of a king of Fakaafu shows him thus adorned.¶

* On Ponape, the dress of chiefs is pandanus leaves *crimped*. Brigham—*loc. cit.*, iii., p. 49.

† This kind of cord is used in some of the New Ireland dance masks in the Australian Museum.

‡ Gill—*Jottings from the Pacific*, 1885, p. 17.

§ Wilkes—*loc. cit.*, p. 41.

|| Journ. Polyn. Soc., i., pp. 41, 42.

¶ Journ. Anthropol. Inst., xxi., 1892, pl. iii., fig. 1.

WEAPONS AND TOOLS.

OFFENSIVE WEAPONS.

As previously stated, on p. 45, the Ellice Group has enjoyed peace so long that not only have the making and handling of weapons fallen into disuse, but all instruments of war have now disappeared. No exact account of these seems to have been preserved in literature. Shark tooth knives were described to me by old men and are recorded by early travellers. Figures of such in the *Ethnological Album** are referred with doubt by Edge-Partington to the Ellice Group.

In the absence of extinct originals, models locally made are of some interest. An aged, white-haired, and tattooed native of Funafuti made for me such of two weapons as previously used by his tribe:—

A missile, "apa," (fig. 14) is a smooth, spindle-shaped piece of hard, heavy wood, probably *Pemphis*, sharply pointed at each end. It weighs one pound five ounces, and measures two feet in length and one and three quarter inches in greatest diameter. In battle it was thrown at an enemy, and was probably capable of inflicting an ugly wound upon a naked foe. The Tahitians had "the tiora, a polished dart about three feet long, cast from the hand generally in the naval engagements, but occasionally on land."† From the Gilbert Group, Edge-Partington figures a missile club, "goramaton," similar to this.‡ An Australian weapon, "konnung,"§ closely resembles this pattern in use and appearance. Indeed so simple an article might be expected to independently recur in different quarters of the world.

The model of the sword-club, "lakautaua,"|| (fig. 15) is roughly made, but probably presents the general appearance of the ancient weapon. A narrow lanceolate blade, truncate at the extremity, tapers to a rounded handle. From a central longitudinal keel, where the thickness is an inch and a quarter, the sides thin down to a square edge a quarter of an inch thick. At half the weapon's length, a notch half an inch deep is cut on each side. From a point an inch



Fig. 14.



Fig. 15.

* *Loc. cit.*, i., pl. xxxvii., figs. 6-11; pl. xxxviii., figs. 1-5; Additional Notes; ii., pl. lxxxix., fig. 8.

† Ellis—*op. cit.*, i., p. 298.

‡ *Id.*, *loc. cit.*, ii., pl. xcv., fig. 12.

§ Brough Smyth—*loc. cit.*, p. 302, fig. 64; and R. Etheridge, Junr.—Macleay Memorial Volume, 1893, p. 240.

|| Cf. Wilkes—*loc. cit.*, v., p. 16.

distant from these notches to the distal end the blade is ornamented on both sides and faces by twenty shallow grooves, separated by interstices of equal breadth, so alternating with those of the opposite surface as to serrate the edge of the weapon. These grooves perhaps represent a degeneration from the toothed edge of certain Samoan clubs.* The use of these teeth and notches probably was to catch and snap the spears of an enemy.

The lakautaua is of hard wood, probably *Pemphis*; it weighs one pound three ounces, and measures one foot seven inches in length, and two and a half inches in breadth.

Among the Penrhyn Islanders, Lamont remarked that:—"The long, light, paddle-shaped club used by the women is called 'coerarai,' and is used in battle principally for breaking the spears of the men of the opposite party."†

The rough sketch and brief notice do not admit of satisfactory identification, but a species of lakautaua is suggested to me by a drawing‡ in the Ethnological Album, described as a "flat wooden fan, stained black in places: Tokelau Island, Union Group." Should "fan" be a grimly ironical misnomer for a messenger of death, the black stains may be those of human blood. The probable inaccuracy of the ethnological statement is countenanced by the geographical confusion of this quotation.

A club figured by Edge-Partington§ as from Fiji, has several features in common with the Funafuti model, such as the proportion of handle to blade, and the raised central keel and distal truncation of the latter. Perhaps one of a group of articles figured by Wilkes from the Kingsmills stands for another.||

ADZES AND AXES.

In 1773 Captain Cook found iron already in the hands of the South Sea Islanders. The process, then commencing, of replacing stone, shell, and bone with metal is now completed. For there is not an island, however remote, in Polynesia where non-metallic adzes are any longer used, only the remembrance of them existing in the minds of the oldest natives.

The collection of Ellice adzes and axes falls into two divisions, the ancient, non-metallic and extinct types represented by models, and those now in use in which a metal blade has been adapted to the ancient tool. Stone blades being obviously unattainable, the models of ancient adzes were set with shell ones. In every case the shell was *Tridacna*, though it is probable that in Funafuti, as elsewhere in the Pacific, other mollusca such as *Mitra episcopalis*, or *Terebra maculata*, would sometimes furnish adze-heads.

* Such as Edge-Partington—*loc. cit.*, i., pl. lxxiv., fig. 2.

† Lamont—*Wild Life among the Pacific Islanders*, 1867, p. 133.

‡ Edge-Partington—*loc. cit.*, ii., pl. xevi., fig. 3.

§ *Loc. cit.*, ii., pl. liv., fig. 1.

|| Wilkes—*loc. cit.*, v., p. 79, the object lying furthest left.

The *Tridacna* shell, particularly the thick part near the hinge, was in former times highly and widely esteemed for this purpose, as is recorded by Keate from the Pelews,* by Finsch from the Carolines, Marshalls, and Gilberts,† by Guppy from the Solomons,‡ by Dixon from Malden Island,§ by Wilkes from the Paumotu,|| by Moseley from the Admiralties;¶ and from Nanomea in the Ellice itself Finsch obtained a specimen of a *Tridacna* axe.

It would hardly have been anticipated that natives, like the Solomon and Pelew Islanders, in the possession of hard volcanic rock would have thus used this material, but Finsch repeatedly remarks that the greater toughness of the shell gives it an advantage over the more brittle stone.**

In the Carolines the same author found the *Tridacna* blades to assume various shapes, of which he figures a broad deltoid and a narrow chisel form.†† Some of these attain an immense size, reaching twenty inches in length and ten pounds in weight; such, he says, were common property.

Describing relics of the race who formerly inhabited Malden Island, Mr. W. A. Dixon writes:—"In the grave was a hatchet head with polished edge made from the shell of a tridacna. . . In many places there were numerous axe heads chipped roughly out of tridacna shells. These are tolerably easily made, the shell being first broken transversely, when a blow on the fractured surface breaks out from the interior of the shell an adze-shaped piece which seems to me to be the pattern on which many of the South Sea stone adzes are formed."‡‡

These tools are thus described by Keate, from the Pelews:—"Their hatchets were not unlike those of the South Sea Islands, the blade part being made of the strongest part of the large *Kima Cockle*, ground to a sharp edge. . . . Uncouth as their hatchets might appear to our people, it was a matter of surprise to observe in how little a time the natives were able to fell a tree with them, though not without breaking several."§§

A glance at a stone adze in the exhibition case of a museum might not impress a spectator with a high opinion of its utility

* Keate—An Account of the Pelew Islands, 1788, p. 312.

† Finsch—Ann. K. K. Naturhist. Hofmus., viii., 1893, p. 65.

‡ Guppy—The Solomon Islands, 1887, p. 76.

§ Dixon—Journ. Roy. Soc. N.S.W., ix., 1877 (1878) p. 175.

|| Wilkes—*op. cit.*

¶ Challenger Reports—Narrative, i., pt. ii., 1885, p. 716.

** "In Lepers Island, the stone adzes were called *talai maeto*, black clam shell, a name now given to iron; the native adze was evidently at first of shell, *talai*, and when stone was used the old name was retained." Codrington—The Melanesians, 1891, p. 314.

†† Finsch—*op. cit.*, p. 214, figs. 36-38.

‡‡ Dixon—*op. cit.*

§§ Keate—*op. cit.*, p. 312.

but on the first occasion on which I saw a stone adze used, my previous ideas on this subject were promptly dissipated. Passing a canoe-builder at work in Kerepunu, British New Guinea, I observed him hewing with a steel tomahawk while beside him lay a rotary stone adze. Being requested to show how the latter was employed, the native obligingly laid aside his European tool and resumed the Papuan one. Three years daily toil in the Queensland bush with an American axe had made me familiar with its use, and it was with the critical eye of a fellow-craftsman that I watched the Papuan axeman. I expected to see him chop with short, light strokes, but with astonishment I saw him plant his feet firmly, swing his adze over his left shoulder at full arm's length, sliding the left hand down the handle in doing so, and then, rising slightly on his toes, bring it down with all the force of every muscle in his arms, back, and legs. After freeing the chip, the adze went up and round and down, and down again, in the most workmanlike style. Under these blows a rain of chips, long, broad chips, sprang from the adze blade over the heads of the bystanders. The aim proved equal to the force, as a strip of timber disappeared inch by inch under well directed even strokes.

The model on which is based fig. 16, has a handle sixteen inches long, the shape of that of the ordinary plane iron adze. A short limb, six inches in length, departs from the handle at an angle of about thirty-five degrees, on the outer distal side of which the adze head is let in. Flat sinnet, interlaced as shown in the figure, binds this on firmly. The head itself is a rough deltoid chip, three inches long, two broad, and half an inch thick, from the valve of *Tridacna squamosa*, the inner face of the valve being applied to the wood, while upon the outer the ridges, furrows, and scales can still be distinguished; a blunt chisel edge is produced by grinding the outer surface. This tool was known in Funafuti as the "toki fasua" (*lit.* *Tridacna* Adze).



Fig. 16.

Another extinct type, reproduced in models for me by the natives, was the "toki fonu," or Turtle Axe. It is exceptional to find an axe (as opposed to an adze) in Polynesia.* The Tongans could only express an axe to Mariner by circumlocution as, "togi fucca anga gehe—an adze having the blade differently turned with respect to the handle." The range of this type is probably inconsiderable, as other lands

* In Papua the ceremonial tools seem all axes, not adzes. Finsch figures a hoop-iron axe from the Dentrecaesteaux;—*Ethnol. Atlas*, pl. i., fig. 8.

yield superior material in abundance, and it may fairly be assumed to be restricted to the low coral islands of the Central Pacific. Edge-Partington cites* these axes from Nukulailai, Nieuve, the Gilberts, and New Caledonia, the last I suspect to be erroneous. They were observed by Whitmee (*ante*, p. 45) on Vaitupu. The Australian Museum possess a series from Mortlock Island. A group of these turtle axes is published by the former author under the erroneous heading of "Bone War Axes."† As a matter of theory these articles seem too light, weak, and clumsy, to serve a warrior; the feel and balance of a real weapon, of however humble an origin, is unmistakable and when gripped by even the hand of an ethnological student can stir a man's blood with magic invitation. As a matter of fact I have Mr. J. O'Brien's assurance that these axes were kitchen utensils, used by the women to split coconuts and chop the soft pandanus boughs. It answers, in fact, to the wooden adze used in Tahiti for splitting breadfruit.‡ Turtle axes from Matty Island differ from other known forms in having the blade pinned instead of lashed to the handle.§



Fig. 17.

The model represented in fig. 17, has for handle a round, fairly straight stick, sixteen inches long and an inch thick. At the distal end a groove three and a half inches long and a quarter of an inch deep is cut to receive the head. This is a trapezoid piece of turtle (*Chelone midas*) carapace, six and a half inches long and, across the blade, four broad, which is ground on its inner surface to a chisel edge; the proximal end is pierced with two circular holes, through which pass the strands of sinnet that firmly bind the head to the handle.

The ordinary form of adze, which every man owns and reckons as his most useful possession, is the plane-iron adze, the "toki" of Funafuti, a word which reappears as "togi" in Tonga, and "tosi" in Penrhyn Island, etc. The plane-iron adze is the direct descendant of the *Tridaena* adze of ancient days, being used and mounted

* Edge-Partington—*loc. cit.*, i., pls. xiv., cxxxii.; ii., pl. xciv.

† Again (*Journ. Anthropol. Inst.*, xxv.) a turtle-shell axe from Matty Island is described as used in battle. The intrinsic evidence of the description is not convincing, since an edge which would not slice cheese is said to slice flesh. This Matty Island axe seems to me designed for lopping pandanus fruit from the tree. In this paper the race inhabiting Matty Island is not classified. A comparison of the articles described there with those of Funafuti forcibly suggests to me a Polynesian source.

‡ Ellis—*Polynesian Researches*, i., 1832, p. 177, fig.

§ Edge-Partington—*Journ. Anthropol. Inst.*, xxv., 1896, pl. xxiv., figs. 11, 12.

similarly. This tool plays the part in Polynesia which the tomahawk takes in Australia; in a native's hand it does duty for half the tools in a carpenter's kit, a keen edge is always kept on the blade, which is used with skill, speed and accuracy. The Funafuti natives when carrying an adze usually prefer rather to hook it over the shoulder than to grasp it in the hand. I observed the same trick in British New Guinea and in the Dentrecasteaux Archipelago. Keate figures a native of the Pelew Islands in this posture,* and Moseley another from the Admiralty Islands.†

The original of fig. 18 was a parting gift from my Polynesian friend its owner, whose name is carved upon the handle. In weight it is fourteen ounces, and in length seventeen and a half inches. The handle, the shape of the Arabic numeral 7, is highly polished by hand friction, it differs from that of the Tridacna adze only in the blade being let in for a greater length, but a quarter of the length of the iron projecting beyond the wood. This is an ordinary European plane-iron sunk in a bevel, and is attached by interlaced sinnet as described in the case of the Tridacna axe. From the Admiralty Islands an almost identical specimen was procured by the "Challenger" Expedition.‡



Fig. 18.

The Rotatory Adze is constructed with such mechanical ingenuity that it is difficult to believe it to be an indigenous possession of a people so low in the state of civilisation as the subject of our study.§ From negative evidence I judge that the Rotatory Adze formed no part of the Polynesian heritage, but that its presence in Funafuti is due to that intercourse with the Gilberts which conferred so many benefits upon the southern archipelago.||

For a contrivance of so much interest the Rotatory Adze appears to have attracted scanty notice in ethnological literature. The mechanical principle of this tool has in the Pacific developed three expressions.

* Keate—*op. cit.*, plate facing p. 55.

† Moseley—*Journ. Anthropol. Inst.*, vi., 1877, pl. xxiii., fig. 2.

‡ Moseley—*Challenger Reports—Narrative*, i., pt. ii., 1885, p. 716, fig. 247.

§ In Java a reversible axe-adze was used, the head being bound on with raw hide, and in Central Africa another reversible axe-adze was employed.

|| But the following sentence in a description of Hawaiian tools indicates apparently that the Rotatory Adze existed there. "In a form much used for the interior work of a canoe, the stone is so mounted as to turn to one side or the other, thus becoming, as needed, a right or left-hand adze."—*Cat. Bernice Pauahi Bishop Museum*, pt. i., 1892, p. 43.

(I.) The Western Papuans make a club-shaped adze-handle, through a perforation in the thick end of which is thrust the mounted stone adze-head, the latter rotating as required in the perforation.* The Australian Museum possess a series of this pattern, collected by the Expedition of the Geographical Society of Australasia to the Fly River, and also an instance from Hermit Island to the west of the Admiralty Islands.†

(II.) The second type, possessed by the Eastern Papuans, has been described by Finsch,‡ who states that it is called "lachela" on the South Coast of British New Guinea, and "ki," or "kis" in Finschhafen, German New Guinea. Here the stone blade is firmly attached to a wooden cone, the wood and stone together constituting the moveable adze-head, the upper surface of the short limb of the adze-handle is sloped and hollowed to receive the cone of the adze-head, and both cone and limb are embraced in a wide band or sleeve of woven rattan. When it is desired to rotate the blade, the butt of the adze head, which usually projects beyond the adze-handle, is tapped and slides forward, the adze-head is then turned to the required angle and thrust back into the rattan sleeve. Every subsequent blow, by driving the cone along and up the wedge of the short arm of the handle, tends to jamb the adze-head tighter into the rattan sleeve.§

(III.) To the third expression, employed by the Micronesians, belongs the Funafuti tool, which invited attention to the foregoing; the only reference to this, known to me in literature, is more than a century old. Keate,|| writing of the Pelew Islands, remarks that, "they had also another kind of hatchet, which was formed in a manner to move round in a groove, that the edge might act longitudinally, or transversely, by which it would serve as a hatchet, or an adze, as occasion required." He also gives an elaborate engraving of this tool with the legend, "A moveable Hatchet." On comparing Keate's picture and account with Finsch's sketch of a *Tridacna* adze from Kusaie (Carolines)¶ I am

* This type is figured by Jukes—Voyage of the "Fly," i. 1847, plate facing p. 274; by D'Albertis—New Guinea, ii., 1880, figs. 6 and 11 of plate facing p. 378; by Finsch—Ethnological Atlas, pl. i., fig. 5; and by Edge-Partington—*loc. cit.*, i., pl. cxcviii., fig. 1.

† Moseley figures and describes—*loc. cit.*, ii., p. 717, fig. 249,—an axe from the Admiralty Islands, of which the blade was "merely jammed in a slot cut in a club-like billet of hard wood near its end." Other relations between the Fly River and Northern Papuans are referred to by Haddon—Cunningham Memoirs, x., 1894, p. 84.

‡ Finsch—*op. cit.*, iii., 1888, p. 328, fig. 36; vi., 1891, p. 71; also Ethnol. Atlas, pl. i., figs. 4, 7.

§ In an unfigured and undescribed type from New Britain, the shorter limb of the adze-handle tapers to a point and is received by a socket of wood and cane attached to the blade.

|| Keate—An Account of the Pelew Islands, 1788, p. 312, pl. ii., fig. 3.

¶ Finsch—*op. cit.*, viii., 1893, p. 215, fig. 39.

tempted to believe that the German traveller had before him a Rotatory Adze, though the distinguishing feature of it escaped his observation. My reasons for this opinion are that the shell blade is shown not directly connected with the handle, but inserted into a separate holder which is in turn fastened to the handle; and further that in the immovable adzes the method, which I have already described, of lashing the blade to the handle, is quite different, whereas the mode and lashing of the Caroline adze is exactly that of the Pelew Rotatory Adze, namely one series of backwardly and another of forwardly directed cords, arising from opposite sides of the handle and meeting above. This arrangement is seen again in an axe-adze Finsch figures from Guap, near D'Urville Island, German New Guinea.* The drawings of Edge-Partington are not sufficiently elaborated to permit much appeal to detail, but the points just discussed suggest to me that an adze, figured as from Pitcairn Island,† is probably a Rotatory Adze. Recollecting that the "Bounty" mutineers found Pitcairn uninhabited, I regard this locality with suspicion. Others figured as from the Carolines, Santa Cruz, New Guinea and New Zealand (!)‡ may perhaps belong to the group under consideration, as may that shown on p. 313 of Codrington's Melanesians.

If it be accepted, as it generally is, that the Plane-iron Adze is the direct descendant of the Stone or Shell Adze, then it cannot be denied that the Rotatory Adze here figure is derived by parallel descent from an adze like that figured by Keate. Various aspects of a specimen of the Rotatory Adze now in common use in Funafuti, where it is called "atupa," are shown by fig. 19. The handle of the atupa differs from that of the toki, in that the short arm is produced so as to transform the T into an oblique and unsymmetrical T. The example selected for illustration weighs one pound, six ounces; the handle is two feet long and the head half as much. In this particular instance the cutting edge is a European hoe-blade; in another, part of an iron door-hinge has served, and probably scrap-iron in almost any form

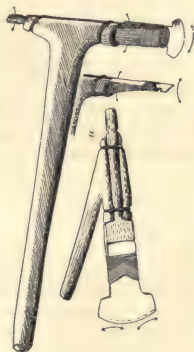


Fig. 19.

* Finsch—Ethnol. Atlas, pl. 1, fig. 7.

† Edge-Partington—*loc. cit.*, ii., pl. xv., fig. 5.

‡ *Loc. cit.*, ii., pl. xciii., fig. 3; i., pl. ccc., fig. 3; pl. cccxxx., fig. 3; pl. clxii., fig. 4.

would be utilised. The iron is let into and lashed to a spade-shaped holder in precisely the fashion in which the plane-iron edge is fastened to its adze-handle. This wooden holder is about ten inches long, consisting of a round rotating shaft about six inches long and a wedge-head, the latter being four inches long, two broad, and at the thick end an inch and a quarter deep. The base of the wedge grinds against the truncated arm of the handle which receives the shock of the blow, while the shaft is nearly buried in a deep groove along the T head of the handle. Both handle and holder are cross-furrowed by two deeply incised ring-grooves, one before and one behind, while vestiges of a third are apparent. Stout sinnet bindings occupy these grooves and keep the holder in its position in the groove of the handle.



Fig. 20.

Another, and as Keate's figure suggests, probably archaic, method of lashing the holder to the handle is shown (fig. 20) by a specimen I sketched, but could not obtain, on Funafuti.

PUMP DRILL.*

Perhaps the only existing people who do not practise perforation by drilling are the Australian Aborigines, who however incidentally drilled holes in the process of making fire. The Polynesians are much more advanced.

The Pump Drill of the West Pacific never fails to elicit expressions of surprise and admiration from those who first see it used by the natives. So attractive a subject has naturally received due attention from travellers, and as several good figures of it have already appeared, I need not here burden literature with more.

The pump drill seems to have been an evolution from the simple shaft drill, from which it arose by easy and natural improvements. The simple shaft drill, as the older and simpler form, was wider spread in space consequent on its superior antiquity allowing it the greater chance of passing from people to people to remoter limits. When European civilisation invaded the Pacific and commenced to deaden the progress of native manners and customs, the pump drill was probably overtaking and replacing the simple shaft drill on the periphery of an out-rippling circle.

To trace the path of either form would be to unravel the vexed question of the origin of the Pacific races. "The rotatory drill," says Brigham, "and the kupaaikē adze are both Papuan

* For an account of the pump drill beyond the geographical limits of the present article, see J. D. McGuire—A Study of the primitive methods of Drilling—Report of the U.S. National Museum, 1894, (1896) p. 733.

inventions now spread through the Pacific.”* If so they must have been transmitted to Hawaii by the Micronesians. A possible source of the ancient, simple, shaft drill of the Pacific, is Japan, where Morse thus describes its use:—“For drilling holes, a very long-handled awl is used. The carpenter, seizing the handle at the end, between the palms of his hands, and moving his hands rapidly back and forth, pushing down at the same time, the awl is made rapidly to rotate back and forth; as his hands gradually slip down on the handle, he quickly seizes it at the upper end again, continuing the motion as before.”† Such a drill is introduced into a scene in the island of Rawak, Dutch New Guinea.‡ Cook noticed this simpler form of drill from Tahiti, and he observed awls armed with sharks’ teeth used by the Tongans and the Maories.§ The Maori greenstone meris are said to have been drilled with a weighted strap drill. “To drill the hole for the thong in the handle . . . pieces of sharp flint are set in the end of a split stick, being lashed in very neatly. The stick is about fifteen or eighteen inches long, and is to become the spindle of a large teetotum drill. For the circular plate of this instrument the hardened intervertebral cartilage of a whale is taken. A hole is made through, and the stick firmly and accurately fixed in it. Two strings are then attached to the upper end of the stick, and by pulling them a rapid rotatory motion is given to the drill. When an indentation is once made in the pounamu the work is easy. As each flint becomes blunted it is replaced by another.”|| From New Caledonia I have had a description of a stick drill on a large scale, used for making the nephrite ceremonial axes; to this a stone is slung, performing when set spinning, the office of a fly-wheel. The shaft drill survived till lately on Erromanga, New Hebrides, whence the Rev. H. A. Robertson procured models, now in the Australian Museum. Fire-sticks and the long spines of Echini supplied the Fijian’s boring apparatus.

The structure and use of the pump drill is thus described by Dr. Turner:—“Take a piece of wood, eighteen inches long, twice the thickness of a cedar pencil. Fasten with a strong thread a fine pointed nail, or a sail needle, to the end of this sort of spindle. Get a thick piece of wood, about the size of what is called in England a ‘hot cross bun,’ and in Scotland a ‘cookie,’ bore a hole in the centre of it, run the spindle through it, and wedge it fast about the middle of the spindle. At the top of the spindle fasten

* Brigham—*loc. cit.*, pt. iii., p. 31.

† Morse—*Japanese Homes*, 1888, p. 40.

‡ Voy. Uranie et Physicienne, 1829, pl. 46.

§ Cook—*First Voyage*, ii., 1773, p. 219; *Last Voyage*, i., 1785, pp. 160 and 395.

|| Chapman—*Trans. N. Z. Inst.*, xxiv., 1891 (1892) p. 499. Another type is figured, *loc. cit.*, pl. xxviii.

two strings, each nine inches long, to the end of these strings attach the ends of a common cedar pencil, forming a triangle with a wooden base and side strings. Stand up the machine with your left hand, place the iron point where you wish to bore a hole, and steady the spindle with your left hand. Take hold of the pencil handle of the upper triangle, twirl round the spindle with your left hand, which will coil on the strings at the top to the spindle, pull down the pencil handle quickly, and then the machine will spin round. Work the handle in this way up and down, like a pump, the cord will alternately run off and on to the spindle, and the machine will continue to whirl round, first one way and then the other, until the pearl shell or whatever it may be, is perforated.”*

Perhaps the earliest account we have of the pump drill of the Pacific is the excellent engraving and description of one procured from Fakaafu by the American Expedition on the occasion of their discovery of that island.† Turner fully describes this drill and its use in Samoa,‡ and a Samoan example is figured by Edge-Partington.§ At Treasury Island, Solomons, Dr. Guppy saw Mule, the chief, using a pump drill for “piercing the holes for the rattan-like thongs in the planks of his canoe.”|| Edge-Partington supplies an illustration of a pump drill with a stone point and a turtle fly-wheel from Malayta, Solomons;¶ and Codrington describes certain disks as “drilled with a pump drill, in Florida ‘puputa,’ in San Christoval ‘nono.’”** Its existence in British New Guinea is attested by D’Albertis, who figures one from Naiabui;†† by Stone, who figures and describes another from Port Moresby;‡‡ and by Edge-Partington, who figures a third from Kerepunu;§§ the two latter are peculiar in the substitution of a bar for a fly-wheel. In 1890, I observed a native in the village of Toulon Island engaged in making beads from *Strombus* shells with the aid of a pump drill. “The rotatory drill was known to the Hawaiians; before the advent of iron the point of a *Terebra* shell served for borer, but in modern times a triangular file was generally used.”|||

* Turner—Samoa, 1884, p. 169.

† Wilkes—*loc. cit.*, v., p. 18, fig.

‡ Turner—*loc. cit.*, p. 169.

§ Edge-Partington—*loc. cit.*, i., pl. lxxvii., fig. 1.

|| Guppy—*loc. cit.*, p. 76.

¶ Edge-Partington—*loc. cit.*, i., pl. cci., fig. 3.

** Codrington—*The Melanesians*, 1891, p. 325.

†† D’Albertis—*loc. cit.*, pl. facing p. 378, fig. 19.

‡‡ Stone—*A Few Months in New Guinea*, 1883, p. 72, fig.

§§ Edge-Partington—*loc. cit.*, ii., pl. 174, fig. 4.

||| Brigham—*loc. cit.*, pt. ii., p. 44; pt. iii., p. 31.

No drills, I believe, existed on Funafuti at the date of our arrival. The natives were, however, well acquainted with the tool and described them to me as formerly in use pointed with *Terebra maculata* and *Mitra episcopalis*; a clumsy model of one, pointed with a fragment of *Pteroceras*, was made on the island for one of our party. On Fakaafu, Lister saw a drill pointed with a sea urchin's tooth. On the neighbouring atoll of Nukulailai I was able to secure a specimen in actual use. Here it was called "milli," and was chiefly employed in making pearl-shell fish-hooks. This specimen weighs six and a half ounces, measures twenty-one inches in total length, is fitted half-way with a fly-wheel four and a half inches in diameter and three-quarters of an inch thick of European or American deal, from one end a rod a foot long is swung from nine inch long sinnet cords, and to the other end is lashed a pointed, steel, triangular, saw-file.*

RASP.

Woodwork, trimmed into shape by the adze, received a finish from the rasp, "jiri," made of the rough skin of the Ray. An unmounted fragment, such as a piece of the tail, sometimes served, but more usually the skin was neatly mounted on a wooden handle.

The natives of Fakaafu, "had saws and files, formed of shark's skin stretched on sticks, which in their hands were quite effective in wearing away the soft wood.† From Santa Cruz and Banks Island, New Hebrides, Edge-Partington shows similar mounted rasps.‡ Lamont relates that at Penrhyn Island:—"The spears are finally polished with the 'poerare,' a kind of rasp, of fish-skin, fastened on a stick.§" Captain Cook saw on Tonga "rasps, of a rough skin of a fish, fastened on flat pieces of wood, thinner on one side, which also have handles."||

Ling Roth figures a "file made of fish-skin gummed on to wood, from S.E. Borneo."¶

The Funafuti specimen of which figs. 21 and 22 give back and front views, weighs three and a



Fig. 21.

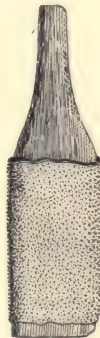


Fig. 22.

* Since the preceding pages were printed off, a figure and description (Journ. Anthropol. Inst., xxvi., 1897, p. 433) of the New Caledonian drill, therein mentioned, have reached me. † Wilkes—*loc. cit.*, v., p. 17.

‡ Edge Partington—*loc. cit.*, i., pl. clxiii., fig. 9; ii., pl. lxxxvi., fig. 3.

§ Lamont—*op. cit.*, p. 155.

|| Cook—*A Voyage to the Pacific Ocean*, i., 1784, p. 395.

¶ Ling Roth—*Natives of Sarawak and British North Borneo*, ii., 1896, p. 256.

half ounces, and is eleven inches long by two and three-quarters wide. The sheet of ray skin is six inches by four, and is sewn together at the back with fine sinnet. The bleached condition of the wooden handle shows it to be drift wood, and the weight and grain agrees with that of red cedar (*Cedrela toona*).

Rasps were also improvised out of a rough piece of coral.

SPADES.

The literary history of the spade in the Pacific is both brief and obscure.*

An article is represented in the Ethnographical Album,† which Dr. Gill describes as “the ancient spade of the Mangaiians, always used in a squatting posture, also used (and intended to be used) as a club”; Edge-Partington further figures a series‡ described in the margin as “steering paddles,”§ but which are indexed as “spades”; from Fiji a spade-blade of tortoiseshell, bored for lashing to a handle, is represented;|| from Samoa is shown¶ an instrument referred to as a “spade (?) of Pinna shell”; and from Tonga a *Meleagrina margaritifera* valve, bored and similarly mounted on a pole, is classified as a “spade(?)”**

On Fakarava, Paumotu Group, Stolpe obtained a “model of spade wherewith aforetime they buried their dead. The model, which is of the actual size, consists of a staff, with a great pearl mussel shell fast bound to either end by coconut plaiting. The entire implement is 146 cm. long.”††

Of the Tongans, Captain Cook wrote:—“The instruments they use for this purpose [digging], which they call *hoo*, are nothing more than pickets or stakes of different lengths, according to the depth they have to dig. These are flattened and sharpened to an edge at one end; and the largest have a short piece fixed transversely, for pressing it into the ground with the foot. With these,

* For remarks on the use of agricultural implements in New Zealand, see Polack—Manners and Customs of the New Zealanders, ii., 1840, p. 194; and in Australia, R. Etheridge, Junr.—Proc. Linn. Soc. N.S.W., ix., (2), 1894 (1895), pp. 109-112.

† Edge-Partington—*op. cit.*, i., pl. v., fig. 6.

‡ *Id.*, *loc. cit.*, pl. xxxvi., figs. 1-3.

§ All the steering paddles that I have seen were carved solid in one piece, and the frailty of the specimens drawn suggests to me that he who ticketed these articles “steering paddles,” had not acquired his lore in the salt air and sunshine of the Southern Seas. For he had surely never seen a steering paddle jammed hard down with all the force of the brown steersman’s arm and watched the surging water straining it as the tall and tasselled prow swung slowly up to windward.

|| Edge-Partington—*op. cit.*, pl. cxix., fig. 12.

¶ *Id.*, *loc. cit.*, ii., pl. xlv., fig. 3.

** *Id.*, *loc. cit.*, ii., pl. l., fig. 9.

†† Trans. Rochdale Lit. and Scientific Soc., iii., 1893, p. 112.

though they are not more than from two to four inches broad, they dig and plant ground of many acres in extent.”*

Though the peculiar method of mounting the blade by boring and lashing to the pole, may be useful as a clue in distinguishing the Pacific spade, it cannot be regarded as a feature separating it from other implements. A type of New Caledonian axe† shares this character, and in the Gilbert Group the paddles are made in this way, as Wilkes has shown‡ and Finsch confirmed.§ With the Gilbert paddle agrees another figured from the Admiralty Islands by Moseley,|| and a specimen from Anchorite Island in the Australian Museum. Indeed the Pacific spade suggests for itself a polyphyletic origin from the paddle of the Gilbert Islander, the club of the Mangaiian, or the axe of the New Caledonian.

In the Ellice, two agricultural implements existed. A species of mattock, resembling an adze of which the minor limb was lengthened and armed with turtle carapace, was obtained by one of the officers of H.M.S. “Penguin,” on Funafuti. A cognate tool is mentioned by Finsch from Mortlock Island.¶ Another of our party also procured some indifferent models of a spade, or long-handled shovel, on Funafuti, where their use had been long abandoned and their place taken by metal bladed substitutes.

On Nukulailai, however, I found this type surviving and in daily use. A specimen I there procured is shown by figs. 23 and 24. This spade is in two parts, a handle and a blade; the former is a pole, perhaps of *Ochrosia* wood, five feet long and an inch and a quarter in diameter, and the latter an oval, spoon-shaped board of perhaps *Calophyllum* wood, sixteen inches long, nine wide, and half-an-inch thick, proximally it narrows to a shaft four inches long and one and a half wide, which is bound to the pole, additional strength being given by lashings which pass round the pole through two pairs of perforations in the



Fig. 23.



Fig. 24.

* Cook—A Voyage to the Pacific Ocean, i., 1785, p. 392. A Maori spade and hoe are figured by Taylor—New Zealand and its inhabitants, 1870, pp. 360, 423; and the Hawaiian by Ellis—*loc. cit.*, iv., p. 195.

† Edge-Partington—*op. cit.*, i., pl. cxxviii., fig. 3.

‡ Wilkes—*loc. cit.*, v., p. 52, fig. § Finsch—*loc. cit.*, viii., 1893, p. 70, fig. 12.

|| Moseley—Journ Anthropol. Inst., vi., 1877, pl. xxii. ¶ Finsch—*loc. cit.*

blade, bored respectively at five and seven inches from the stem. The blade is straight longitudinally, but transversely the curving sides rise an inch and a half above the centre. Such are frequently constructed of broken or disused wooden basins.

KOUTEKI.

The method of climbing palms in Funafuti has been described on p. 26. The "kouteki" used in that operation is illustrated



Fig. 25.

by fig. 25; the side shaded in my drawing being the face applied to the palm trunk. This article

is carved from a hard dark wood, perhaps *Calophyllum*, weighs four and a half ounces, is twenty-one inches long, two broad, and one thick.

COCONUT SCRAPERS.

An ordinary kitchen utensil is the "twaikarea," or mounted scraper. Of this the old form has entirely passed out of use, having been replaced by an iron instrument. I was, however, by the courtesy of the late king's daughter, so fortunate as to receive from her as a return gift for a bottle of European scent, the specimen shown by fig. 26, which was, I was assured, the last survival in the atoll, if not in the archipelago, of the ancient pattern, where its place is taken by a metal substitute. In use the twaikarea is laid upon the ground and the blade is thrust through one of the loose coco-leaf mats; sitting down, the operator rests the thigh on the straight shaft of the utensil to keep it firm, and grasping a split coconut rocks it over the blade till the kernel is shredded away. The shreds are then gathered from the mat for cooking or making oil.



Fig. 26.

The method of using this instrument on Funafuti is shown in the accompanying sketch (Plate xiv.), for which I am indebted to my friend Mr. Norman Hardy. In Matty Island it appears that the operator does not sit, but stands on the instrument and stoops to his work.

The wooden holder whose worn and discolored appearance indicates a respectable antiquity, consists of a cone departing at

half a right angle from a straight board, all being in one piece of a kind of hard, white wood unknown to me. The board or seat is eighteen inches long, an inch thick, three inches wide at the end, and four at the elbow. The cone is six inches long, and tapers from two and a half inches at the base to an inch at the summit. On the upper side it is excavated to receive the blade. A spoon-shaped fragment, four inches long and two wide, from the columella of the "karea" shell (*Pterocera lambis*), ground to a chisel edge on the outer side, constitutes the blade, which is retained in position by interlaced lashing of sinnet, like that of the adze. The weight of this implement is one pound eight ounces. Upon an emergency a twaikarea might be used, I was informed, as a substitute for the toki fasua.

Somewhat different are the coconut scrapers figured and described from Matty Island, in German New Guinea.*

An homologous utensil, "kamdjoo," consisting of an armed stick sloping in a fork stuck in the ground, is recorded from the Ladrões.†

Of this latter type a specimen from the Marshall Islands, set with a blade of hard coconut shell, is contained in the Australian Museum. This form was probably steadied by the knee when in use. The localities suggest that it will prove a characteristic of Micronesia.

The article just described is intended only for scraping the kernel of the coconut shell which has become firm and thick with age. Another kind of scraper is used to prepare pap for infants' food from the soft kernel of the half-grown nut. The latter kind seems to be in common use over a wide area and usually takes the shape of a slip of pearl shell an inch or two inches broad and twice as long, having the broader end finely serrated. Some I collected at Mita, Milne Bay, British New Guinea, were called there "kahi." From the Solomons, Edge-Partington figures two examples,‡ the former from New Georgia being etched pictorially on the concave face. Finsch illustrates another from Finschhafen, German New Guinea.§ On Penrhyn Island:—"With a piece of mother-of-pearl, called a 'tuè,' some six inches long, and tapering to a point, and about two broad at the base, where it is nicked like a saw, they scrape the meat very fine. This they do by placing a half nut between their legs, pressing the edge down with the left thumb, holding the tuè like a pen, in the right hand,

* Edge-Partington—Journ. Anthropol. Inst., xxv., 1896, p. 294, pl. xxiv., figs. 7, 8.

† Freycinet—Voyage Uranie et Physicienne, ii., 1829, pp. 313 and 447, pl. lxxix., fig. 2.

‡ Edge-Partington—loc. cit., ii., pl. ci., fig. 12; pl. cxii., fig. 8.

§ Ethnological Atlas, 1880, p. 26, pl. v., fig. 8.

and scraping from the edge downwards, the left forefinger pressing on and assisting the others in the operation.”*



Fig. 27.

On Nukulilal I procured a specimen, called “twai,” cut from *Meleagrina*, one ounce in weight, three and three-quarter inches long, and tapering in width from an inch to an inch and a half. On Funafuti pearl shell was a material too precious for this use, and hard coconut shell was employed in the specimen drawn in fig. 27, which is three-quarters of an ounce in weight, four inches in length, and tapers from a broken point to an edge an inch and three-quarters broad, denticulated by thirty small teeth.

The ribs and carapace of *Chelone midas* are formed into scoops “sesefonu,” for paring the kernel of coconuts. No two



Fig. 28.



Fig. 29.

of the series collected at Funafuti are quite alike. Variations selected for illustration show—the former, (fig. 28) a double-ended scoop, an ounce and a half in weight, an inch broad, and seven and a half long; the latter, (fig. 29) two and a half ounces in weight, eleven inches in length, and one and a half in width, at one end it tapers to a point and at the other is bevelled three inches on the concave surface to the blade.

To this category probably belongs a Fijian article sketched by Edge-Partington† described in the margin as a “taro spade of bone,” but corrected by Sir Arthur Gordon in “Additional Notes” to “implement of turtle bone used for preparing puddings.”

A scoop was occasionally improvised from a valve of the common *Asaphis deflorata*.

IMPLEMENTS FOR FISHING AND HUNTING.

FISH-HOOKS.

The fish-hooks used by the Ellice Islanders may conveniently be grouped under three heads; firstly, those made in one piece and used baited in the ordinary way, secondly, those made with

* Lamont—*loc. cit.*, p. 117.

† Edge-Partington—*loc. cit.*, i., pl. cxix., fig. 16; see also ii., pl. lix., fig. 7.

separate barb and shank, baited and sunk for deep sea fish, and thirdly, those also made of two separate pieces but trailed unbaited on the surface. The two latter types, highly specialised forms, are still in common use, but the former more generalised pattern has been entirely superseded by European metal hooks. The Octopus bait of stone and cowry shells, so frequently used in Polynesia was not seen by me on Funafuti, though Lister records it from Fakaafu.

SIMPLE FISH-HOOKS.

Of the old-fashioned hooks carved in one piece no actual specimens exist to-day on Funafuti. A few of bone and pearl shell, which had survived till our visit, were carried away by the Expedition, and I am partly dependent for my information upon models of extinct types made for me by old men.

An old type, the "matou tifa,"* which I saw in the possession of a native, but failed to procure, is figured (fig. 30) from a pencil drawing made on the spot. It was of pearl shell, about two inches in diameter and a third of an inch thick. So excessive is the curvature that the inner margin describes three-quarters of a circle. The base is expanded to afford a grasp for the fishing-line, the tip is tapered gradually to a sharp point, distant a third of the circumference from which is a sharp backwardly directed barb.



Fig. 30.

Such hooks were seen by Captain Cook in Tahiti, and the manufacture of them he thus describes:—"The manner of making them is very simple, and every fisherman is his own artificer: the shell is first cut into square pieces, by the edge of another shell, and wrought into a form corresponding with the outline of the hook by pieces of coral, which are sufficiently rough to perform the office of a file; a hole is then bored in the middle, the drill being no other than the first stone they pick up that has a sharp corner: this they fix into the end of a piece of bamboo, and turn it between the hands like a chocolate mill; when the shell is perforated, and the hole sufficiently wide, a small file of coral is introduced, by the application of which the hook in a short time is completed, few costing the artificer more than a quarter of an hour."† Finsch gives a description which corresponds with Cook's, and illustrates his remarks with diagrams of half-made hooks from Nukuor in the Carolines.‡

* In Mariner's Tongan Vocabulary, fish-hook is "matow."

† Cook—*loc. cit.*, p. 219.

‡ Finsch—*loc. cit.*, p. 333, pl. iii., figs. 9, a., b.



Fig. 31.

Another antique form, called simply "tifa," of which I was fortunately able to secure an authentic example, is shown by fig. 31. It is osseous, formed probably from the carapace of a turtle, a third of an inch thick, and an inch and a half in diameter, and weighs two drachms forty-nine grains. I was informed that such hooks were occasionally made of hard coral. From the preceeding it differs in the shape and position of the barb. When the hook lies before the observer, with the barb pointing downwards, the

hook has somewhat the form of a C. A hook of this type is figured from Fakaafu by Lister.* Hooks resembling this form are figured by Finsch,† but here the ends are reversed, what forms the barb in the Ellice hook being the point of attachment of the fishing-line in the Caroline one, and *vice versa*. On the other hand various Tahitian hooks figured by Edge-Partington‡ agree with mine. As Finsch remarks, it is difficult to understand how fish were caught with these blunt and clumsy hooks, but that they effectually served their purpose is certain.



Fig. 32.

A small comma-shaped tortoise shell hook is called "faba" in Funafuti. Though an inch in length, it is barely a millimetre thick, weighing three grains. The specimen figured (fig. 32) is a model of an extinct species, made for me on Funafuti. Though there are vague references in literature to small turtle shell hooks in the Pacific, I have not been able to find a figure or description corresponding to my specimens. Keate tells us that the Pelew Islanders made their fishing hooks of tortoise-shell, one of which he figures.§

Some of the hooks in the Australian Museum, wrought from turtle shell, show evidences of having been bent by heat, but the Funafuti ones seem to have been carved cold.

PEARL SHELL BONITO HOOKS, "BAWONGA."

These fish-hooks represented to the Ellice Islanders of past generations their most valued treasures. Apart from their intrinsic worth they acquired, as conveying a maximum of wealth in a minimum of space, an artificial value approximating to the coins of more advanced civilisations. Instances have been given of their presentation to the gods (p. 47), of their burial with the owners (p. 53), and of their transmission from atoll to atoll by

* Journ. Anthrop. Inst., xxi., 1892, pl. ix., fig. 2.

† Finsch—*loc. cit.*, pl. iii., figs. 5, 6, and 7.

‡ Edge-Partington—*loc. cit.*, ii., pl. xxi.

§ Keate—*op. cit.*, p. 311, pl. ii., fig. 4.

Frigate-birds (p. 59). In Tonga the hook of the god Tangaloa was an heirloom preserved for many generations.

In this Archipelago their value was heightened by the rarity and inaccessibility of the shell, (*Avicula cumingii*) from which they are manufactured; hardly any are found at Funafuti, and the Group is principally supplied from a bed in the Lagoon of Nukulailai, whence they are procured by expert divers.

This type of hook is universal throughout the Pacific, being used alike by Melanesians, Polynesians, and Micronesians. Besides those collected by the Expedition, the Australian Museum contains instances from Manihiki and Mortlock Islands, and the Gilbert and Hawaiian Groups. Among Edge-Partington's sketches may be recognised further instances from Danger Island, Strong's Island, Tahiti, Tonga, and the Solomons.* In addition, Finsch quotes this type from the Carolines, the Marshalls, and the Marquesas.† In New Zealand, where the substance of which it is usually manufactured does not exist, the Maories found in the shell of the "pawa" (*Haliotis iris*), a substitute for the flashing nacre of the *Avicula*. But this shell being too brittle to stand alone, is supported by a backing of "totara" wood (*Podocarpus totara*). It is used, according to Hutton,‡ for catching the "kahawai" (*Arripis salar*). The barb is itself single or double recalling the Tongan pattern. Specimens of this interesting variation lie before me in the Museum collection, and correspond fairly to the instances figured by Brough Smyth§ and Edge-Partington.||

The habits of the Bonito (*Thynnus pelamys*), for whom these hooks are intended, resemble those of its near relation the European mackerel; they eagerly rush at and swallow any attractive object, guided apparently by sight, not scent.

Of the considerable literature which has accumulated on the subject, probably the first notice of the use of these hooks is Captain Cook's remark of them in the hands of Tahitian anglers¶:—"Of fish-hooks they have two sorts, admirably adapted in their construction as well to the purpose they are to answer, as to the materials of which they are made. One of these, which they call 'wittee wittee,' is used for towing. The shank is made of mother-of-pearl, the most glossy that can be got: the inside, which is

* Edge-Partington—*loc. cit.*, i., pl. lxii, fig. 0; pl. lxxxvii., fig. 8; pl. clxxvii., figs. 9, 10; pl. ccix., figs. 4, 5, 6; ii., pl. xxi., figs. 1-3.

† Ann. K. K. Naturhist, Hofmus., viii., 1893, p. 332. A Caroline specimen is figured in the Voyage Uranie et Physicienne, pl. lviii., fig. 10.

‡ Guide to the Collections in the Canterbury Museum, 1895, p. 217. See also Wakefield—Adventures in New Zealand, i., 1845, p. 93.

§ Aborigines of Victoria, i., 1878, p. 392.

|| Edge-Partington—*loc. cit.*, i., pl. cccxci., fig. 9.

¶ First Voyage., ii., 1773, p. 218.

naturally the brightest, is put behind. To these hooks a tuft of white dog's or hog's hair is fixed so as somewhat to resemble the tail of a fish; these implements, therefore, are both hook and bait, and are used with a rod of bamboo and line of 'erowa,' [a kind of nettle which grows in the mountains]. The fisher, to secure his success, watches the flight of the birds, which constantly attend the Bonetas when they swim in shoals, by which he directs his canoe, and when he has the advantage of these guides, he seldom returns without a prize."

This sport is thus vividly described from another island by W. T. Pritchard*:—"Bonita fishing is, perhaps, the most risky of all Samoan adventures. The natives start off at the dawn of day, and paddle far out to sea in the calm of the morning, and there trail their hooks behind the canoes, heedless of the brewing storm, and trusting to the strength of their arms and the fleetness of their skiffs, to reach the shore before its full force overtakes them. The bonita are found in 'shoals,' with birds hovering over them; and when these birds are still further out to sea, the fishermen bend to their paddles, and the canoes skim over the waves until in the midst of the 'igafo,' as the shoal is called. There the hook, still trailing from a long bamboo rod over the stern, is played to and fro, and as the bonita bites at it with a spring and a splash, he is tossed up with a jerk, and landed in the canoe with a shout and a cheer."

The bamboo does not grow in Funafuti, where the fishing-rods are chosen from the "miro," *Thespesia populnea* (p. 37). In Tahiti, the rod has bunches of feathers to imitate birds.† In action the rod butt fits into a rope eye slung from the aftermost thwart (like a sprit-yard when it is shipped in an eye slung from the mast), it reclines in a raised rest carved on the after-decking of a Funafuti canoe (Plate xv.) At Simbo, in the Solomons, Mr. Hardy tells me that a bamboo scoop is drawn through the water to attract the bonito.

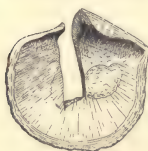


Fig. 33.

The shank "ba," of the hook is carved from an *Avicula* valve, so that a slice from the thinner part of the valve is attached to a thicker ridge from the hinge. A valve of *A. cumingii*, from which a hook had been cut, or rather I presume sawn along the sides and snapped off at the tail, which I procured on Nukulilai is figured (fig. 33) to illustrate the mode of manufacture. In one hook from Funafuti (fig. 34) the shank

* Pritchard—Polynesian Reminiscences, 1866, p. 175; see also Wilkes—*op. cit.*, v., p. 11.

† Ellis—*loc. cit.*, i., p. 148.

is compound, being lengthened and strengthened by a strip of pearl shell, neatly fitted and lashed to the butt-piece. This is the only instance of such that has come to my notice, and doubtless was the result of economy in the use of a rare and valued substance. This hook is the largest of the series from Funafuti, being three inches and a quarter in length, but it is dwarfed by a specimen from Manihiki, six inches long. In weight it is six drachms nine grains. I did not see the whole process of manufacture, but such as I saw, nearly completed, in Funafuti were fashioned with but one tool, a small hard piece of *Montipora* coral called "lapa," with which the implement was rasped into the desired shape. The tail end of the shank is either made forked or square. The opposite thicker end of the shank is so designed to bear the perforation necessary for lashing on the fishing-line.



Fig. 34.



Fig. 35.

In the article (fig. 35) taken half-finished from the workshop, the perforation has not yet been made. This hole is drilled with a tool just like that figured by Wilkes* from Fakaafu, in the Union Group. No specimens of this existed on

Funafuti when we were there, though they were described to me as having formerly been used tipped with *Terebra maculata* or *Mitra episcopalis*. Critical examination reveals that these perforations were not drilled from one side through to the other, but half through from one side to meet half through from the other. The face of the shank corresponding to the exterior surface of the valve was ground till the dull dark surface disappeared, the convex surface of the finished hook always presenting the most brilliant lustre. It is asserted by fishermen that a particular color of the nacre is preferred by the fish, and a hook is tried, polished, and re-polished till the exact play of light is obtained.

Among the hooks from Funafuti the makers have chosen as material for barbs, "wonga," bone (probably of *Delphinus*, possibly of *Sus*), mother-of-pearl (*Avicula*), and turtle-shell (*Chelone*). One from Tahiti with a barb of *Pinna* shell is figured by Edge-Partington,† and doubtless other substances would be found on examination of a large series. A Gilbert Island example in the Museum Collection has for barb a bent copper nail; and a hook from Funafuti (fig. 36) is armed with a piece of steel wire bent and pointed. The separate pearl shell barb from a half finished article (fig. 37) of Funafuti will convey an idea of its proportions.

* Wilkes—Nar. U.S. Explor. Exped., v., 1845, p. 18.

† Edge-Partington—*loc. cit.*, ii., pl. xxi., fig. 2.

Two perforations are the rule, but in the specimen with the compound shank a third exists. Unlike the kahawai hook from New Zealand, the barb is always simple in the Central Pacific type.



Fig. 36.



Fig. 37.



Fig. 38.

To the shank the barb is securely lashed by twine threaded through the perforation, the distal of the two lashings also serves to hold the beard; in the specimen figured (fig. 38) this latter is of European cotton thread, but usually it is of native fibre. The hook is made more secure by wedging on either side of it under the lashing, a piece of wood, which, in the examples at my disposal, is invariably from the mid rib of a coconut frond pinnule. Finsch* describes such wedges as of bone or fish-bone splinters.

A hook which differs from the usual type is represented in the Australian Museum from Mortlock Island. This pattern has been noted from Strong's Island by Edge-Partington,† and has been well figured from Mortlock by Finsch.‡ It differs markedly by the shape of the barb, the angle at which it is set, and especially by its mode of attachment to the shank and severance from the fishing-line. The tail end of the shank is deeply cut by two pair of notches to which the barb is fastened by a species of "cross-seizing." The hinge of the *Avicula* is cut lengthwise to form the shank of this hook, not as usual across.

The taste of the fish or caprice of the artificer results in much diversity of beard, "singa." In Funafuti, white feathers (which appear to my colleague, Mr. A. J. North, to have been plucked from the breast of the Black-naped Tern, *Sterna melanauchen*) are in vogue. In one hook (fig. 34) a pair of these feathers ornament the tail end of the shank, their shafts being twisted into the furthest lashing upon the lower surface. Two pair are inserted upon the other specimen figured, (fig. 38) in a corresponding situation, while a third pair garnish the fishing-line near the butt end of the hook. Finsch § quotes specimens from Nukuor, in the Carolines, collected by Kubary, adorned with black feathers. From the preceeding extract, it will be seen that Captain Cook observed dog's and pig's hair used in Tahiti. An instance is before

* Finsch—*loc. cit.*, p. 331.

† Edge-Partington—*loc. cit.*, i., pl. clxxvii., figs. 9-10.

‡ Finsch—*loc. cit.*, pl. iii., fig. 1.

§ Finsch—*loc. cit.*, p. 332.

me of European lamp-wick forming a beard for a Manihiki hook, and a Gilbert Islander has so utilised a bit of canvas ; the Museum series further afford a Mortlock hook bearded with dressed *Hibiscus* bark. Pieces of tappa cloth, varying in colour according to the kind of fishing, are mentioned by Finsch from the last-named Island.

The hook with which the great god Tangaloa dragged up Tonga from the bottom of the sea, was described as "made of tortoise-shell, strengthened by a piece of the bone of a whale ; in size and shape it was just like a large albacore hook, measuring six or seven inches long, from the curve to the part where the line was attached, and an inch and a half between the barb and the stem."*

The fishing-lines attached to these hooks are always sold together with them ; being required to endure tremendous strain, they are fastened to the hooks inseparably. In the Ellice, as in the Gilbert and Manihiki specimens, these are composed of *Broussonetia*, and are fine, white, three-ply cord, two to three mm. in diameter, of immense strength. In the words of Captain Cook,† the Polynesians "make the best fishing-lines in the world : with these they hold the strongest and most active fish, such as bonetas and albacores, which would snap our strongest silk lines in a minute, though they are twice as thick." Dr. Finsch informs us that in the Carolines the fishing-lines were constructed of *Hibiscus* fibre, and that the Archipelago was chiefly supplied with this article from Nukuor.

Synopsis.—This kind of fish-hook may, on the model of systematic biology, be classified as follows :—

Genus TRAILED PEARL SHELL HOOKS.

Description.—Of two pieces, pearl shell shank and attached hook of the same or other substance, large, bearded, trailed on the surface without bait, principally employed for bonito ; extends throughout the Pacific.

Type.—Fig. 38, p. 270.

Species A.—Type species.

Description.—Shank mother-of-pearl, bored at thick end to attach fishing-line, which is then carried along the face of the shank and made fast to the barb, tail not serrated ; beard and barb of various substances.

Locality.—Pacific.

* Mariner—Tonga, i., 1817, p. 285.

† Cook—*loc. cit.*, p. 218.

Sub-species A.

Description.—Metal barb, shank flat and notched to fasten fishing-line.

Locality.—Ellice Group.

Type.—Fig. 36, p. 270.

Species B.

Description.—Fishing-line not carried to barb, barb lashed to serrations on the tail of the shank, shank perforated for fishing-line.

Locality.—Mortlock and Strong's Islands.

Type.—Finsch, Ann. K.K. Naturhist. Hofmus., viii., 1893, pl. iii., fig. 1.

Sub-species B.

Description.—Shank notched or toothed, not perforated, for reception of fishing-line.

Locality.—Solomon Islands.

Type.—Edge-Partington, Ethnol. Album, ii., pl. ccix., fig. 5.

Species C.

Description.—Kahawai hook, shank of pawa face and wood backing, barb bone and double barbed at tip.

Locality.—New Zealand.

Type.—Smyth, Aborigines of Victoria, i., 1878, p. 392, fig. 230.

Species D.

Description.—Shank round, barb shaped like a scythe blade, no beard.

Locality.—New Guinea.

Type.—Finsch, Ethnol. Atlas, pl. ix., fig. 3.

PALU HOOKS.

As characteristic an ethnological feature of its especial region as the boomerang of Australia or the bola of South America, is the wooden deep sea fish-hook from the Central Pacific. All authors in dealing with this remarkable type of large wooden hook from Micronesia and Polynesia have termed it a "shark" hook. In the preceding pages, (p. 199) a description by Mr. Louis Becke is given of the "shark," for which this instrument is intended. This excellent account, though not couched in technical language, clearly indicates that the fish in question, the "palu," is no shark, and has suggested to Mr. E. R. Waite the idea of some Macruroid.

"This peculiar fish," writes Becke, "is, as far as I know, only found in the Tokelau, Ellice, and Kingsmill Groups, and at the isolated islands of Pukapuka (Danger Island), Suwarrow, and Manabiki. I do not know for certain, but I have been told by many intelligent natives that the palu is *never* to be found among the high islands, such as the Fijis, Samoa, New Hebrides, &c." He also mentions catching palu at Nieuë.

Tracing the geographical distribution of this hook, we note it recorded from Nanomea,* by Brill; from Nukufetau in the Ellice, Nukuor in the Carolines, and Tarowa in the Gilberts, by Dr. Finsch;† from Nukulailai, Nieuë, Tamana, and the Union Group, and possibly an eccentric type from the Louisiades,‡ by Edge-Partington, and the latter also by Macgillivray;§ a drawing of a Penrhyn Island hook, by Wilkes,|| may be intended for this type; while a huge form is represented in the Australian Museum from the Mortlock Group, and another variation is pictured from the Trobriands by Finsch.¶ A specimen resembling the latter, said to come from Milne Bay, B.N. Guinea, was lately procured by Mr. Norman Hardy at Samarai, and will be described shortly in the Proceedings of the Linnean Society of New South Wales.

Lister** figures a palu hook from Fakaafu, and from Atafu, Dr. Coppinger†† procured "a large wooden shark-hook, with rope snooding made of coconut fibre." A modification of the usual pattern is shown from Fiji in the Macleay Museum, Sydney, agreeing with a figure by Edge-Partington.‡‡

The shape of the palu hook is roughly that of a V or U, of which one arm projects beyond the other, the shorter being turned at right angles towards the longer and ending in a sharp point. So bizarre a form rather strains the application of ordinary terminology, but the re-entering point, seen on closer examination to be a separate piece, may most conveniently be termed the "barb," the remainder of the hook the "shank," while a coconut fibre rope always attached to the longer limb, and homologous

* Brill—*Ethnographische Abtheilung, Katalog*, i., 1897, pl. vi., fig. 365.

† Finsch—*Ann. K. K. Naturhist. Hofmus.*, viii., 1893, pp. 54 and 333, pl. iii., figs. 14, 15.

‡ Edge-Partington—*loc. cit.*, i., pl. lxxvii., fig. 6; pl. cccvii., fig. 4; ii., pl. xcv., fig. 1; pl. xcvi., figs. 1, 2.

§ Macgillivray—*Voy. "Rattlesnake,"* i., 1852, p. 198, fig.

|| Wilkes—*U.S. Explor. Exped.*, iv., 1845, p. 307.

¶ Finsch—*Ethnol. Atlas*, 1881, pl. ix., fig. 9.

** Lister—*op. cit.*, pl. ix., fig. 2

†† Coppinger—*Cruise of the "Alert,"* 1883, p. 157.

‡‡ Edge-Partington—*loc. cit.*, i., pl. cxvii., fig. 11.

with the piece of cat-gut on an European fish-hook, will be spoken of as the "cord of attachment."

The exact shape of the manufactured article depends on the growth of the fork from which it is hewn, and therefore exhibits considerable variation, especially in the angle in which the limbs diverge. I procured on Nukulailai rough forks (fig. 39) such as



Fig. 39.



Fig. 40.

schoolboys select for making catapults, in the bark, intended for palu hooks. I recognised the bark, and the natives further informed me that the wood was "vala vala," (*Premna taitensis*). Dr. Finsch supposed that mangrove furnished the material of the Gilbert Island hook he described.

In Tahiti, Ellis tells us that the wooden shark hooks, a foot or eighteen inches in length, were cut from the roots of the "aito" tree (*Casuarina equisetifolia*), an exposed growing root of which was sometimes twisted into the shape desired for the future hook.*

In the carefully finished example figured (fig. 40), the shank is flattened at the fork and rounded on the limbs; this is not, however, the case in other specimens of rougher workmanship. This

* Ellis—*loc. cit.*, i., p. 146.

Funafuti example selected for description weighs, with its cord of attachment, three and a quarter ounces; the greatest length is nine and a quarter inches, the shorter limb is seven and three-quarter inches, the greatest width between the limbs is one and three-quarter inches, and the length of the barb is two inches.

The separate barb is roughly L-shaped, one limb being bevelled to form a scarf-joint with the shank, the other carved into the exact shape of a fowl's spur, to which, when affixed to the shank, its resemblance is increased by occupying the same relative position to the limb of the shank as the spur does to the fowl's leg. The joint is completed by a whipping for its entire length of flat sinnet. The most striking peculiarity of the palu hook is the extent to which the entering barb is carried, almost closing the loop of the hook. As the length of the barb is proportionate to the size of the hook, the size of the aperture is decided, not by the length of the barb but, by the divergence of the limbs of the shank. The specimen figured is extremely narrow, a quarter of an inch only separating the point of the barb from the opposite limb of the shank. Finsch's Tarowa hook exhibits an opposite extreme of width which can be matched in a hook from Nukulailai, where three-quarters of an inch intervene between barb and shank. If the hook is held before the eye so that the shorter limb of the shank appears super-imposed upon the longer, the barb is usually seen to be slightly deflected to the right. When, as in the Mortlock hooks, this feature is exaggerated, the complete hook is thrown into an ascending spiral. Considerable diversity exists in the method of splicing the barb to the shank. In the Ellice Islands the face of the joint is in a plane at right angles to the plane of the hook, but the Funafuti craftsmen attach the barb to the inner face of the shank, whereas the men of Nukulailai fasten it (as is shown in the barbless shank on Finsch's plate, and as Edge-Partington correctly figures it) to the outer side, as do also the fishers of Fakaafu.

Reference has previously been made to a series of hooks from the Mortlock Group* in the Australian Museum. Compared with the Ellice hooks these are enormous, the largest weighing one pound fifteen and three-quarter ounces, and measuring seventeen and a half inches. Grooves gnawed by captured fish upon the shanks attest their genuineness, and their size suggests that they were intended for a form of palu larger than that taken in mid-Pacific. In all points of construction they conform to the smaller type except in the setting of the barb. Here the scarf-joint is cut in the plane of the hook, that is, at right angles to the Ellice Island joint.

* Which of the two groups known by this name is intended is uncertain, but probably the northern is meant.

The longer or unarmed limb of the shank terminates in a knob on the outer side, half an inch below which is carved a smaller projection. The cord of attachment is a piece of round plaited coconut rope (oukafakanapoua) about two feet in length; the loop in which it ends is slipped over the smaller projection of the shank, and the cord lashed securely to the inner side of the shank by sinnet passing between the knobs. In the Mortlock hooks the cord of attachment terminates distally in a loop, evidently for "bending on" the fishing-line, in which it agrees with the Gilbert Island type; in the Ellice a knot ends this cord.

One Mortlock specimen has a straight stick, fourteen inches long and half an inch broad, so lashed on to the cord of attachment as almost to hinge to the long limb of the shank. A somewhat similar but not identical method of mounting the palu hook is shown by Edge-Partington* in an instance from Niue. No Ellice hooks present this feature, but we cannot assert that they may not also be thus prepared for service.

Mr. O'Brien told me that the bait was a whole fish split and laid scale to scale upon either side of the barb. In bolting this the palu, whose jaws are very thin and pliable, gets the barb caught behind the angle of the jaw. Sometimes, when the fish bites, the line is so jerked as to bang its head with the flat stone used as a sinker.

Finsch gives the name of this hook in the Gilberts as "tingia," the name of it on Funafuti is "kou boru."

MESHING NEEDLES.



The meshing-needle, "afa," is carved from mangrove (*Rhizophora*) wood; in length it is sixteen or eighteen inches, in breadth about an inch across the eye and three-eighths across the shaft. The eye is about an eighth of the total length, the proximal end of it is cut either square or pointed, and the distal end simply split. The Funafuti pattern (fig. 41) is hardly to be distinguished from one used by English fishermen. The Australian Museum possesses examples of this implement exactly like the above, received from Greenwich and Sikaiana Islands.

Further modifications are given by Edge-Partington Fig. 41. from various Pacific Islands.† One such shuttle, ready loaded, depends from a group of Papuan implements figured by Lindt from China Straits.‡

* Edge-Partington—*loc. cit.*, i., pl. lxxvii., fig. 6.

† Edge-Partington—*loc. cit.*, i., pl. xxxii., figs. 15, 16, from Tahiti; pl. cxlii., fig. 22, and pl. cxix., fig. 14, from Fiji; pl. clxxvi.; ii., pl. cxliii., fig. 6, from New Guinea.

‡ Lindt—*Picturesque New Guinea*, 1897, pl. xlv.

HAND-NETS.

"Tei" is the name of a small hand-net (figs. 42, 43) for use in the rock pools of the reef at low tide. It consists of a bag net mounted upon a frame and set upon a stout ten-foot pole, probably of

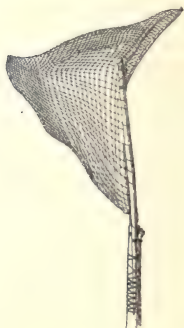


Fig. 42.

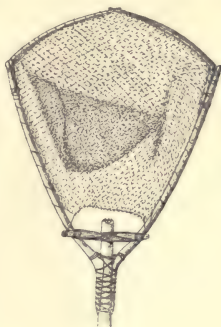


Fig. 43.

Thespesia. The frame is in four pieces, apparently *Rhizophora* wood. Two forks, somewhat the shape selected by boat-builders for knees, are so trimmed and set that while the shorter arms, three inches long, clasp the handle, being lashed thereto with fine sinnet, the longer arms, nineteen inches long and half an inch in diameter, continue nearly in the plane of the pole and diverge symmetrically from each other at an angle of about forty-five degrees. Two shorter pieces, about ten inches long and a third of an inch thick, are at their bases jointed on to the inner extremities of the longer arms, by the same method as the former are attached to the pole, while their extremities are crossed and lashed together. These shorter pieces are so bent that the end of the net is almost at right angles to the remainder of the frame. (fig. 43). Additional security is given by a piece of hard wood, probably *Pemphis*, six inches long, set T-wise on the end of the pole, and firmly lashed both to it and to the frame of the net. The bag is pointed, shallow, about a foot deep, sixteen inches long and fourteen inches wide, of three-quarter inch mesh of fine sinnet. The knot employed in meshing is the universal bow-line or weaver's knot.* The bag is fastened to the frame by a cord

* For instances of the use of this knot by Australian Aborigines, see Brough Smyth—Aborigines of Victoria, i., 1878, p. 390, fig. 225; and R. Etheridge, Junr.—Macleay Memorial Vol., 1893, p. 249, pl. xxxii., fig. 9. For Polynesian instances see p. 64 of this work.

threaded through a mesh of each row and carried spirally along the frame.

No net quite like this seems to be represented in literature, the nearest approach being one figured by Finsch* from the Gilbert Islands.

FOWLING NET.

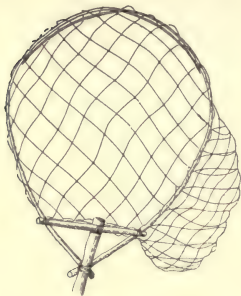


Fig. 44.

The sport of trapping birds with the "shaou-shaou" net has been already described on p. 84. A specimen of a small one (fig. 44) which I purchased on Funafuti measured eighteen by fourteen inches across the mouth. Some nets I saw employed were twice as large. The hoop is constructed by crossing and lashing to the pole the thick ends of two slender flexible twigs, a yard in length. The tips of these were crossed, bent over one upon the other, and thrice lashed. As in the preceeding form, the hoop is secured to the handle by a T-piece.

The bag is eighteen inches deep, is of large four-inch mesh, and is attached to the hoop by the process of reeving the frame through each alternate mesh.

The natives of the Gilbert Group amuse themselves by catching Frigate-birds (*vide* 86) by flinging over them a stone and line. Dr. Finsch has given a vivid description of bird lassoing as practised by the Pleasant Islanders.†

RAT TRAP.

Before the advent of Europeans, and the introduction of the cat, the natives were greatly plagued by swarms of the Pacific Rat, *Mus exulans*. From time to time, when the pest grew beyond endurance, it was the custom of the king to order that at a given time each villager should bring to him a tale of say a hundred rats. For their destruction an ingenious trap was employed which has now disappeared, but which I am enabled to study through a model made for me by one of the oldest inhabitants. In obedience to the order, the rat traps would be repaired and set, every man, woman, and child taking charge of one or more.

* Finsch—*loc. cit.*, p. 56, fig. 4.

† Finsch—*The Ibis*, 1881, p. 248; also *Ann. K. K. Naturhist. Hofmus.*, 1893, viii., p. 35.

These periodical battues were a source of great amusement, none went to sleep till his or her score was complete, for from the trap of any one caught napping the rats were merrily picked.

The model of the trap "tugimoa," which I obtained on Funafuti (fig. 45) weighs a pound. The body of it consists of a barrel eighteen inches in length and two in diameter, of soft white wood, probably *Hernandia*; at one end a chamber six inches deep is excavated, at the other the barrel is narrowed to a wedge and cut to a fork whose lower limb projects beyond the upper like a shark's tail. To each prong of the fork is separately bound the butt of a resilient wand, here termed the bow, of probably *Rhizophora* wood, twenty-eight inches in length. About half way along the barrel a short cross-piece of wood is lashed as a stand.



Fig. 45.

To prevent splitting, the barrel is again lashed with sinnet at the trap mouth. From the slender end of the bow descends a fine sinnet cord, here termed the bow-string. This bow-string is made fast to the bow about six inches from the end, but when in service is carried along to an inch from the end, and there made fast by a clove hitch; when not in use the bow is unstrung by slacking off and slipping down the clove hitch. There are two perforations, three-quarters of an inch apart, and one-eighth of an inch from the entrance, in the roof of the chamber; the bow-string is led in by one and out by the other, and then knotted to prevent withdrawal. Six inches from the barrel a slip of wood, the lever, two and a half inches long is tied to the bow-string. In the chamber roof, in the median line, there is also, at an inch from the entrance a sinnet loop inserted, and at two and a quarter inches from the entrance, is another perforation.

To operate the trap, a bait of coconut kernel is placed on the floor of the chamber, a wooden pin, thrust through the

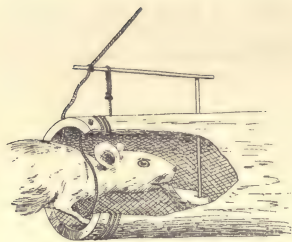


Fig. 46.

fourth perforation, stands on this bait, the bow is bent down till the lever attached to the bow-string can be passed through the loop and rested on the pin-head, thus leaving enough slack of the bow-string bight to form a noose at the entrance of the chamber. The rat, to reach the bait (fig. 46) must put its neck through the noose, then pulling at the bait upsets the pin, which in turn slips the

lever, which in turn releases the bow, drawing the noose tight on the rat.

I have not found a description of a trap from Polynesia answering to this, though it is mentioned by the Rev. R. Taylor that in New Zealand the rat "was formerly so numerous as to form a considerable article of food; it was taken by an ingenious kind of trap, which somewhat resembles ours for the mole."* I am, however, informed by Mrs. Pratt, the widow of the well-known philologist, and by the Rev. George Brown that a trap like that figured above was in common use in Samoa; while Mr. J. S. Gardiner tells me that he observed it both in Rotumah and in Fiji. In these localities the barrel of *Hernandia* wood was replaced by a length of bamboo, one joint of which formed the chamber. This information suggests that as the bamboo did not exist on the Ellice it was perforce copied in wood. Some approach to the principle of it is made by the mole trap still used in the rural districts of England.

CANOES.

One of the most marked distinctions between Melanesians and Polynesians resides in their canoes. "The Melanesian does not venture far out to sea in his canoe; and although in the Solomons the natives make voyages from island to island of two or three hundred miles, these are entirely within the group, and performed exclusively with paddles, sails not being used at all. Indeed I suppose the Solomon Island canoes never go out of sight of land. Coming to the New Hebrides, where the population is almost entirely Melanesian, canoes are conspicuous by their absence, such as are seen being the most wretched affairs, and totally unfitted for any extended voyage."†

* Taylor—New Zealand and its Inhabitants, 1870, p. 496.

† This statement of Mr. Woodford requires qualification, for on Malli-colo I am informed that large well-built canoes exist.

The Polynesian, on the other hand, "is eminently a navigator, venturing far to sea and making considerable voyages out of sight of land in his large out-rigged or double canoe, with its enormous triangular sail. Of course, as to all seafaring people, accidents sometimes happen, a sudden squall or succession of contrary winds prevent the navigators making their port, and the canoe is driven by the winds and currents, until in the majority of cases, no doubt, it is broken up, or its unfortunate occupants are dead of hunger and thirst; but in some instances, after drifting for days, and perhaps weeks, ignorant of their position, they have sighted one of those tiny coral atolls that dot this part of the Pacific, and landing upon it, have formed the nucleus of a future population."*

Gill has described and figured a Polynesian compass-card of thirty-two points, employed by the navigators of the Hervey Islands.† The visits of the Tongan marauders to Funafuti have already been described (*ante* p. 44). The Ellice Group was not the only direction these pirates took, for, besides visiting most of the nearer islands, they had planted a colony in far Mangaiia.‡ In the opposite direction the natives of Tucopia, an islet five hundred miles west of Rotuma, relate that they were once visited "by five large double canoes from Tonga, the crews of which committed dreadful outrages, destroyed plantations, robbed houses, violated the females, and murdered the males."§ Figures of these large Tongan vessels are given by Dumont D'Urville.|| The exploits of Karika who, in his great double canoe with two masts and a crew of one hundred and seventy, made eight wonderful voyages between Rotuma, Savaii, Tonga, and the Hervey Islands, have been chronicled by Gill.¶ P. Smith gives from Fornander "the well authenticated voyages between the Sandwich Islands and Tahiti, a distance of two thousand three hundred and eighty miles," but I have been unable to verify the reference. As late as 1855 a great single Maori canoe lay at Hauraki, N.Z., which measured a hundred and ten feet in length.**

The Micronesian also excels in navigation, the Marshall Islanders disputing with the Tongans the claim to be the boldest and most skilful sailors in the Pacific. Their canoes were provisioned for voyages of the duration of several months. On the sloping

* Woodford—A Naturalist among the Head-hunters, 1890, p. 238.

† Gill—Myths and Songs from the South Pacific, 1876, p. 320.

‡ Gill—Savage Life in Polynesia, 1880, p. 105.

§ Dillon—Narrative of a Voyage to ascertain the fate of La Pérouse, ii., 1829, p. 112.

|| Voy. au Pole sud, Atlas pittoresque, pls. lxxviii., lxxix.

¶ Report Austr. Assoc. Adv. Sci., 1890 (1891), p. 634.

** For descriptions of Maori canoes see Hamilton—Maori Art, pt. i., 1897.

platforms built out on each side there are frequently little houses in which three or four of the crew can sleep.*

"They actually make curious charts ['medo'] of thin strips of wood tied together with fibres. Some of these charts indicate the positions of the different islands with a surprising approach to accuracy. Others give the direction of the prevailing winds and currents. These are used as instruments to determine the course to be steered, so as to take advantage of the wind and to allow for current drift rather than as charts are used by us."†

As the Ellice Islanders formerly fought with the Tongans and traded with the Micronesians, they probably learnt arts of seamanship from friends and foes. Once Funafuti possessed large ocean-going vessels, "fouroua," in which cruises were made to Nui and Vaitupu, but these, Mr. O'Brien told me, had disappeared for more than twenty years. The existing canoes are only small craft, fit but for fishing or for crossing the lagoon. The adventurous spirit which prompted their ancestors to undertake exploring voyages is still alive on the atoll, where there is hardly a man who is not anxious to travel. On leaving, several of my native friends begged me to take them to Fiji or Australia upon any terms.

On Fakaafu, Lister was "told that in the old times they had two vessels—each with two masts, and without outriggers—described as being as large as the trading schooners which visit the island. Each of these would hold, it is said, all the available fighting men in the island, perhaps a hundred and fifty to two hundred men."‡ And Newell "had reliable evidence that until recently there were planks 'two fathoms wide,' the remains of one of these old island canoes to be seen on Fakaafu."§ It was probably in ships like these that the Rotumans used to visit Vaitupu and Nui.||

A method by which the inter-island voyagers secured a beacon for which to steer is thus described by Woodford:—"When I was at the island of Nukufetau, I was told that when they wanted to communicate with the island of Oaitupu, they were in the habit of making fires on the reef for two or three moonless nights in succession, until they saw the glare in the sky from the answering fires made by the natives of Oaitupu. As soon as the fires were

* Finsch—Ann. K. K. Naturhist. Hofmus., viii., 1893, pp. 160, 161, figs. 23, 24.

† Bridge—Proc. Roy. Geogr. Soc., viii., 1886, p. 556. For figures see Cat. Godeffroy Museum, 1881, pl. xxxii.; and Journ. Polynesian Soc., iv., 1895, pl. v., p. 236.

‡ Lister—Journ. Anthropol. Inst., xxi., 1892, p. 57.

§ Newell—Proc. Austr. Assoc. Adv. Sci., vi., 1895 (1896), p. 605.

|| Dillon—*loc. cit.*, ii., p. 108.

noticed on Oaitupu, the Nukufetau canoes used to start early the next morning, and the fires were continued every night on Oaitupu till the canoes arrived, the distance being about thirty-five miles.”*

On Funafuti the priest, “vakatua” chose the auspicious day for starting on a long voyage and in the event of the vessel missing her destination, he might suffer vengeance by being killed and eaten by the crew of starving castaways.

As the gigantic Moas of New Zealand have all perished, leaving their small relation, the Apteryx, alone to represent them, so the huge and ancient vessels of the Pacific, the great double canoes and the plank-built ship described to Lister, have vanished, leaving in existence only the little outrigger fishing canoe, “vaka.” Whether the double canoe was evolved from the outrigger, or the outrigger from the double canoe, or each arose independently of the other, we lack material for profitable consideration.

The size of the timbers used in canoe-building is, of course, directly related to the wealth or poverty of the local forest flora. Finsch’s figure† of a portion of a Gilbert Island canoe, in which seventeen small pieces of wood are neatly fitted together, speaks eloquently of the few and stunted trees growing there.

The specimens and figures of South Sea outrigger canoes within my reach, seem to show that, as has already been demonstrated in the case of most articles and ornaments, each archipelago and almost each island may be distinguished by peculiarities of structure. When these shall have been thoroughly studied, a classification will be possible, now the data is insufficient.

Of the published illustrations of these canoes that I have seen, the nearest approach in general contour to the Funafuti pattern is made by one from Samoa roughly sketched by Edge-Partington.‡ The general association of the two islands would lead us to expect a close resemblance between the object of our enquiry and the canoes of Fakaafu, which are thus briefly described by Lister:—“The canoes of the present time are built just like those of Samoa, having a single outrigger. Owing to the scarcity of large trees on the island, the body of the canoe is built of several pieces, each separately hollowed, and these are laced together with sinnet (plaited coconut fibre). Often there are as many as four distinct pieces along the bottom, and the sides are built up with additional pieces to the required height. Each piece is accurately shaped so that it will fit in among the neighbouring ones, and the joints are caulked with resin. The bow and stern are covered in for a short distance, and on their upper surfaces a number of small pyramidal

* Woodford—Proc. R. Geogr. Soc., x., 1888, p. 352.

† Finsch—Ann. K. K. Naturhist. Hofmus., viii., 1893, p. 68.

‡ Edge-Partington—*loc. cit.*, ii., pl. xliv., fig. 9.

projections are left in the middle line, to which white shells of *Cypraea ovula* are attached for ornament. The upper surface of the stern-piece is not horizontal, but slopes obliquely downwards to the end. The canoes would hold seven or eight people."*

These canoes are propelled both by sail and paddle; the sail was formerly of palm or pandanus mats, and is now of calico. It is hoisted after the ordinary Polynesian method, upon two converging masts, stepped upon the thwarts or gunwale and steadied by a backstay. At each tack the masts and sail are unshipped, and carried round bodily end for end, the craft therefore never "goes about." Under sail they can travel seven or eight miles an hour easily; they lie close to the wind, but for want of a keel make rapid leeway.

With paddles three men are the usual complement, but one alone can handle such a craft comfortably. The paddlers sit on the thwarts, paddling chiefly on the starboard side, as the outrigger impedes them on the port. When in earnest the natives can drive them at a great rate. One day I saw a crew chase, overtake and board a ship which was passing the atoll three or four miles away, and making probably five or six knots. The paddle is never rowed, grasped in both hands it is plunged vertically into the water and withdrawn after a short fore and aft stroke. A course is kept by all without any particular steering. To turn sharply the paddle is struck into the water by the aftermost man as far away as he can reach and pulled through the water towards him. When in sufficiently shoal water, the paddle is always exchanged for the pole, a method of progression which is likewise preferred by the Papuans. For an anchor, a block of coral is made fast to the painter. These canoes draw about six inches and weigh about a hundredweight and a half.

Although there are not, as in other Pacific Islands, jetties or boathouses, the canoes are well taken care of. Returning from an excursion, the canoe is carried to above high water-mark, two men lifting it clear of the ground. Here it is rolled over and lies deck down, hull up, well covered over with a pile of mats till again required. A worn out canoe cuts up into handy troughs or coffins. On Nukulailai the canoes were all tarred over, but on Funafuti they remain unpainted.

I regret my omission to note the native words for the parts and furniture of a canoe.

The specimen before me (Plate xv., fig. 1) of the ordinary outrigger canoe of Funafuti supplies the material for the following figures and descriptions, with which are included a few notes taken on the spot.

The Museum specimen is twenty-three feet six inches in total length, one foot five inches in greatest depth, and one foot three

* Lister—loc. cit.

inches in greatest breadth ; another I measured on the atoll was twenty-nine feet in total length, one foot ten inches in greatest depth, one foot four inches in greatest breadth, twenty feet the open space from deck to deck, twelve feet length of outrigger float, four feet distance from float to hull.

As previously described (p. 32), the hull is hewn out of a log of pouka, which is trimmed down for stem and stern, and, except a foot of deadwood left solid fore and aft, is hollowed to a shell three-quarters of an inch thick. In longitudinal-vertical section it is bow-shaped (the chord above the arc below); swollen in the belly, flexed forward and quite straight aft. In transverse-vertical section it is rounded and flattened beneath, the flattened area being about six inches broad, and extending along the central third of the vessel. Aft from this the tapering sides are flattened to meet in a straight sloping keel which overhangs the water and rises aft. The bows are very sharp and hollow, with a fine slender run aft, the stem is clipper-shaped, the cut-water is one foot long and overhangs four inches, when floating empty the fore foot just touches water.

Upon this hull is built up the top side planking, which, in the specimen under consideration is on the starboard side of one piece twelve feet four inches in length and eight inches in greatest depth ; on the port side it is in two pieces, fourteen feet in length, and nine inches in greatest depth ; both are an inch thick, adzed level to the deck above and sinuous below to follow the irregular curves of the hull. To the hull this planking is attached by a series of lashings placed at intervals of from four to ten inches. The lashings, consisting always of the flat sinnet braid called "kafa," are passed four times through holes bored half an inch within the edge, and knotted at each pair of holes, never being carried along from pair to pair. Where on the port side two planks join, a triangular lashing attaches each to each and to the hull. I have no reliable information of the composition and application of the caulking used in the seams.*

The Tahitians caulked their canoes with the husk of coconut and gum of breadfruit ;† the Penrhyn Islanders stopped holes and seams with coconut husk steeped in water and pounded like flax ;‡ and the Solomon Islanders used a kind of vegetable putty from the nut of *Parinarium laurinum*.§

* Finsch—*op. cit.*, pl. vi., fig. 5, figures a caulking-tool from the Louisiades.

† Ellis—*loc. cit.*, i., p. 156.

‡ Lamont—*loc. cit.*, p. 152.

§ Woodford—*loc. cit.*, p. 158 ; and Sommerville—*Journ. Anthropol. Inst.*, xxvi., 1897, p. 370.

The stern sheets terminate diversely, according to the taste of the architect; a vertical (Plate xv., fig. 3) or horizontal fork, representing, so the natives said, a fish's tail, being popular, and sometimes a turtle's tail is imitated.

Both fore and aft are movable deckings or hatch covers, each carved in one piece, an inch thick, of the full breadth of the hull, with the top sides of which they are flush, their narrow ends countersunk in the deadwood of the head or stern sheets and their broad ends with a finger at each corner which locks under the gunwale rail. The forward decking, two feet eight inches long, carries at its after end a seat carved in relief, hollowed on the inner side, the outer sides of which, rising in a wedge, present a vertical face two inches high and act as a wash board. The after-decking, three feet long, has a corresponding wash board, enclosing a raised rod-rest, a block three inches high, three wide, and four long, hollowed on the inside to receive a fishing-rod whose butt swings in a grummet slung from the aftermost thwart (Plate xv., fig. 4).* Aft from the wash board along the median line of the decking there is in this individual canoe a row of seven little pyramids, each an inch and a half high. Usually they are more numerous and are sometimes continued along past the decking to the extremity of the stern. There appears to be no use for these, though it has been suggested to me that they might be useful as cleats. Lister saw them festooned with *Ovula* shells on Fakaafu. I regard them as purely ornamental, and from their association with the terminal fish-tail I further look upon them as a conventional representation of the peculiar dorsal finlets of the bonito. They are remarkable as being the only ornamental wood carving now executed by the Ellice Islanders.

From the port side of the canoe waist project three outriggers, three feet apart at the hull and slightly spreading outwards. The outrigger butts, one and a half inches square, cross to the starboard side and serve as thwarts in the interval, they are usually sunk in the top sides of port and starboard and firmly lashed thereto. The outriggers are usually entire, but are sometimes made divisible, spliced in a lock-joint and served (Plate xv., fig. 5). The advantage of detaching the outrigger float from the hull occurs when the canoes are beached and rolled over, the separated hull being more manageable. At Funafuti the outriggers are always cut from a straight stick which throws off a branch at an angle of about sixty degrees, such a timber being abundantly supplied by *Rhizophora*; the main stem is cut off six inches beyond the fork, and the branch is continued for eighteen inches, at which point it rests on the

* Cook noticed that in Tonga the fishing-rod "rests in a notch of a piece of wood, fixed in the stern of the canoe for that purpose." Cook—*Last Voyage*, i., 1785, p. 396.

outrigger float. On either side of it, fore and aft, stout pegs, four or five inches long, are driven an inch or so into the solid timber of the outrigger float, to which the outrigger is secured by lashing pegs and outrigger firmly together (Plate xv., fig. 7). This seems to be an exceptional method. In other archipelagoes the outrigger is usually a straight unbranched pole, to which are fastened long stakes driven into the outrigger float. A modification of this is well shown by Finsch from the Louisiades.* The four-inch pegs just mentioned appear to be the homologues of these stakes.

Another method used in Funafuti (Plate xv., fig. 6), is to bore the float horizontally and pass a lashing through the hole and round the outrigger tip. Yet another way of binding the outrigger to the float has been described to me by Mr. S. Sinclair, who saw it practised in Eromanga, New Hebrides. Here the whole structure of outriggers and appurtenances takes to pieces and is packed up when not in use; when set up, a forked outrigger, like that of Funafuti, is lashed by the butt across the hull, while the distal extremity is received into a socket in the float, to which it is secured by fore and aft rope guys leading from the float to the fork, the whole structure is therefore flexible instead of rigid. There are numerous undescribed methods of attaching the float to the outrigger; indeed this subject alone would provide material for a treatise of value and interest.

The float is a round straight log, ten feet long, six inches in diameter, distant four feet from the hull, pointed at both ends. In use it swims awash; when the canoe is heeled gradually over, a capsize occurs the instant the float is lifted clear of the water.

The outrigger platform is completed by three or more stretchers, lashed across the outriggers at intervals, the outside one being always fastened beyond the fork. In Funafuti the platform is only used for carrying paddles, masts, poling sticks, fishing rods, and such gear; it is never sat upon. In New Guinea I frequently made canoe journeys with the natives; there the outrigger platform is always assigned to a chief or "dim dim" (white man) as the seat of honour; † on it I have sat all day and slept all night. On my first canoe trip in Funafuti I at once attempted to climb on to my accustomed perch, an act which not only evoked a howl of remonstrance but nearly upset the canoe. My apparent rudeness and awkwardness taught me with humiliation the difference in the build of outriggered canoes.

For gunwale rails poles are served along each side to the thwarts, but such rails are not always present.

* Finsch—*loc. cit.*, pl. vi., fig. 4.

† Compare Moseley—*Journ. Anthropol. Inst.*, vi., 1877, p. 405.

Like most other Funafuti implements, the bailers are distinguished by their rough, unfinished state. In this they contrast unfavourably with bailers from other archipelagoes which are often highly finished and the subject of decorative carving on their sides, ends, and handle; wherever, indeed, the friction of their office permitted. Occasionally they attain a large size, a giant from the Admiralty Islands, which dominates its fellows in the Australian Museum, measures no less than twenty-three by twelve by eight inches. Though the general plan is common to all Pacific bailers, yet the tongue varies by being sometimes and sometimes not, carried in an arch to the floor. On the south coast of British New Guinea, a large shell, *Melo diadema*, is used as a bailer, the ventral side of the last whorl being knocked out to admit an inserted hand to grasp the columella; and in the Solomons, Somerville saw bailers "of banana leaf stitched into the shape of a small coal-scoop without a handle."* Bailers made from a palm spathe from the Fly River, New Guinea, are in the Australian Museum.

The Funafuti bailer (Plate xv., fig. 8) is a plain, narrow, deep scoop of probably *Calophyllum* wood; in weight one pound five ounces, in length a foot, in depth two and a half inches, and in breadth narrowing from five and a half posteriorly to two and a half inches anteriorly. The sides are at right angles to the back and floor, and the handle is a median tongue attached to the back and floor, seven inches long, an inch and a half deep, and three-quarters of an inch broad; beneath the bailer is rounded to fit the canoe floor. In use it is not filled, lifted, and emptied, as with us, but the water is gathered and shot out at one vigorous sweep.

The paddles (Plate xv., fig. 9) agree with the foregoing in being made strictly for service, not at all for show. A specimen before me weighs two pounds two ounces, and measures four feet six inches in total length, of which half is handle, half blade; the former being an inch and a half square, the latter five and a half inches wide sloping to a thin edge. The blade has sloping shoulders, parallel sides, and lanceolate point. Lister remarks of the Fakaafu paddles that they have, "longer blades than those of Samoa,—in botanical language they are oblong acute, not ovate. This difference may be due to the small size of the timber on the islets."

DOMESTIC ARTICLES.

CORDAGE.

Yarn, "loukafa," for coir ropes is obtained in lengths of about a foot from the husk of green coconuts, macerated for three or four weeks in fresh or salt water. The mode of manufacture is

* Somerville—Journ. Anthropol. Inst., xxvi., 1897, p. 371.

to roll together a dozen loukafa threads upon the bare thigh under the extended palm, at the finish of each up and down rub a slight twist is given by a sideways motion of the hand. The short strings so produced are "amo," two of which are laid together, one projecting half its length beyond the other, and these are rolled together as before. A third string is applied to the second, so that one end lies in a fork between the end of the first and the middle of the second, while the other end projects by half its length beyond the end of the second, and the whole is again rubbed. By the similar addition of amo strings the strand continuously grows. Two such strands are again rolled together to produce the finished article, the ordinary two-ply cord "korokoro." (fig. 47). The fibre of the *Broussonetia* is treated in the same way.



47. 48. 49.

Men and women are equally proficient at this work, which is regarded as a pleasant light employment suitable to gossip over when detained indoors by inclement weather.

A hank of two-ply coconut cord from Funafuti, which weighs three and a half ounces, measures fourteen fathoms, the diameter of the cord is an eighth of an inch. This type is laid up tighter than others, and is the commonest pattern for general use, serving for twine and fishing-lines.

The two-ply cord, the most simple and wide-spread form of cordage, is probably the most primitive. The degraded natives of Tierra del Fuego made a two-ply cord of gut strands; a specimen of which in a shell necklace has been shown to me by the Hon. P. G. King, of this city, who procured it during the historical voyage of the "Beagle." The Australian Aborigines seem only to have known a two-ply cord, though they elaborated a complex form of it by rolling up a two-ply with another two-ply.

An ornamental form of two-ply cord is of a strand of human hair laid up with a strand of bark. Of this pattern is the string of the Funafuti dance armlet. The same pattern may be observed in the decoration of the elaborate dance masks of New Britain and of New Ireland, these masks also carry a variation of the same where a strand of red coloured bark is laid up with a strand of natural yellow bark.

A cord, not to be distinguished from the ordinary two-ply coir cord except by unravelling, was made in Hawaii, of three strands.

The treble stranded cord, "kafa," of Funafuti, is a flat braid, loosely twisted direct from the yarn and made large or small as

required (fig. 48). The especial use of this is for lashing wood-work, as in sewing together the planks of canoes or fastening the frames of houses. An identical cord is made in New Guinea. A hank from Funafuti of three-ply cord, weighing five and a half ounces, measures twenty-eight fathoms, in diameter it is three-sixteenths of an inch. Another example from a kafunga is half an inch broad.

Four strands are plaited, direct from the yarn, to make a round rope, "oukafakanapoua," (fig. 49) of especial strength, used for canoe rigging, deep-sea fishing, etc. This rope is very pliant and does not kink even when new. A hank of this from Funafuti, weighing one pound one ounce, contains thirty-two fathoms of cord a quarter of an inch in diameter. From the Gilbert Islands there are in the Australian Museum samples of human hair-cord woven in this pattern.

Cook said of the Tongans:—"The rope they make use of is laid exactly like ours, and some of it is four or five inch."*

The most complex cord I have seen from the Pacific is a seven-stranded one from Hawaii. From the Marshall Islands Finsch described† a large rope laid by a curious mechanism upon a central core.

In the Ellice a rough rope, like our straw rope, was occasionally improvised from the natural matting which sheathes the budding palm fronds.

BASKETS.



Fig. 50.

Baskets loosely woven from a portion of a palm frond are hastily improvised as needed for carrying fish or other articles. These are never kept to use a second time, but are thrown away when emptied. I have elsewhere‡ described similar baskets from New Guinea, which, however, differ in size and pattern. Those of the New Hebrides appear, according to Lieutenant B. T. Somerville's description, to be made differently from either.

The simplest form (fig. 50) is a sort of tray for carrying fish. The specimen preserved measures about a foot in diameter, in shape is irregularly rhomboidal, and consists of a portion of palm frond rachis with fifteen pinnules attached, which are interlaced and then knotted in two bows.

Another type (fig. 52) is bag shaped. An ordinary example is eighteen inches long and half as deep, formed by doubling part of a frond split down the middle and plaiting the pinnules as before,

* Cook—*loc. cit.*, i., p. 216.

† Finsch—*Ann. K. K. Naturhist. Hofmus.*, vii., 1893, p. 158.

‡ *Proc. Linn. Soc. N. S. W.*, (2), x., 1895 (1896), p. 615, pl. lviii., fig. 2.

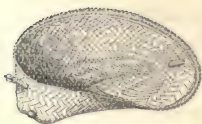


Fig. 51.

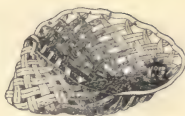


Fig. 52.

The pinnule tips, instead of being knotted at both ends of the basket as in New Guinea, are plaited along the floor and knotted in one bunch inside. A second specimen has the knot outside the basket.

A third type of basket was collected at Funafuti, the specimen of which came from Niutao. This (fig. 51) is a more finished form and was required for permanent, not temporary use. It is two feet long, one foot broad, and six inches deep. Two lengths of split frond are woven together, the two strips from the rachis making a double rim to the basket. No interstices are visible between the strands, of which an inner and an outer layer cross each other obliquely. Each pinnule is doubled, giving a thickness of four leaves to the basket wall. The basket ends are rounded, the floor flat with a median ridge, at each end the pinnule tips are plaited into flat straps, the lower three inches of which are within the basket, but the knotted extremities thereof are carried through the basket wall, making external handles. This form of handle appears to be indicated in a sketch of a Samoan basket by Edge-Partington.* The name of this basket was given me as "kete."

STRAP.

A shoulder-strap for carrying weights (fig. 53) is a plaited band of pandanus leaf seven feet six inches long and an inch to an inch and a half broad. At one end is a knot, at the other a loop, the one intended to be drawn through the other. The native name of this was unfortunately not noted.

A reference in Maori literature appears to relate to a similar article:—"The Kawerau tribe derived their name from the shoulder-straps with which the chief Maki used to carry off his spoil, made of nikau leaves (*rau*); hence the name, *karwe* to carry, *rau* leaves."†



Fig. 53.

* Edge-Partington—*loc. cit.*, ii., pl. xlv., fig. 3.

† Percy Smith—The Peopling of the North, Journ. Polyn. Soc., vi., 1897, Supplement, p. 35. See also Edge-Partington—*loc. cit.*, ii., pl. cxxxiii., fig. 11.

THATCHING IMPLEMENTS.

In thatching and in fastening the rough palm mats to the hut walls, awls and hooks are employed. Edge-Partington has published sketches of needles thus used in Torres Straits, Tahiti, and New Caledonia,* but I observed none such in the Ellice Group. The collection of awls from that Archipelago exhibits great diversity of material, though agreeing substantially in form. From Nukulailai and Funafuti are specimens shaped from turtle bone, "tui fonu"; one from Funafuti is part of a swordfish bill, "tui sokera"; a third type is the spine of a sting ray, "futta," the serrations of which are ground down to make the tool, a half-made instance of which shows the transition.



55. 54.

A highly polished specimen of awl is from Funafuti, it (fig. 54) weighs half an ounce and is seven inches long. The day after I had purchased this from a workman engaged in loading battens with dressed pandanus leaves, I noticed the vendor hard at work with a fresh tool. He was using the handle of a European tooth-brush, ground to a point, and observed cheerily that it was quite as good as the one that he had sold me.

At Nukulailai I procured the original of fig. 55, whose use is to hook and draw through the string or twig used in fastening up mats, etc. It is carved of hard dark wood, probably *Rhizophora*, weighs one ounce, and is ten and a half inches long. Hooks resembling these are referred by Edge-Partington to Tahiti and Samoa.†



Fig. 56.

While stripping the thorns from the edges of pandanus leaves I saw one woman employ a rough leaf thimble to protect the finger-tip. Of this I unfortunately omitted to procure a specimen.

TOSI.

A sort of claw is cut from the hard black shell of the coconut, which is called "tosi," and is used for ripping into fine strips the fibres of the titi dresses. The accompanying figure (fig. 56) represents a specimen, two and a half inches long, from Funafuti.

BROOM.

An excellent broom, "salu," is made from a couple of hundred of the stiff mid-ribs of the coconut frond pinnules, stripped, dried,

* Edge-Partington—*loc. cit.*, i., pl. ccxxiii., fig. 10; ii., pl. xvii., figs. 7-8, and pl. lxi., fig. 4.

† Edge-Partington—*loc. cit.*, ii., pl. xvii., figs. 9, 10; pl. xlv., fig. 2.

and tied together at the proximal end (fig. 57). Its weight is fifteen ounces, length a yard, and diameter of the handle an inch and a half. Not only the interior of the houses but all the village streets are regularly swept by the women, and kept neat and tidy. Many Europeans might copy with advantage from Funafuti; indeed during a residence of some years in the South of Europe I never met a French or Italian village where cleanliness was so thoroughly enforced.



Fig. 57.

FAN.

On Funafuti and Nukulailai I saw several elegant forms of fans, both plain and coloured. These patterns are all recently introduced from Samoa by the Native Teachers of the London Missionary Society, replacing the rougher fans of earlier days, which have nearly disappeared. A specimen of the real old-fashioned fan of Funafuti, "igli," was kindly presented to me by Mr. O'Brien. This (fig. 58) is heart-shaped, of plaited coconut pinnules, the ends gathered into a handle; it is two and a half ounces in weight, eighteen inches in length including the handle, and thirteen wide. The fan-shaped leaf of the *Pritchardia* palm is perhaps the model upon which such a fan was formed. The Samoan fly-flap was not employed on Funafuti.



Fig. 58.

PILLOWS.

The pillow appears in the Pacific in two widely different forms, one that of the wooden head-rest, the other that of the mat cushion. By far the most common is the former, which is found from the furthest western station of the Papuans to the remotest eastern settlement of the Polynesians. In shape it ranges from a solid wooden block to a bar of bamboo mounted on wooden feet. Each race has treated it according to its idiosyncracies; the artistic Melanesian has tastefully carved and painted his, especially in New Guinea, where it is embellished by conventionalised animals whose limbs form appropriate supports; the simple Samoan is content with plain neat articles, while the more progressive Tongan elaborates designs on his; the crudest and roughest articles with which I am acquainted being the head-rest from the Ellice we are about to consider.

The name of both cushion and head-rest was given to me as "alunga," but in Funafuti I saw only the head-rest in use. A distinctive feature of Ellice Island work is its crudity and entire

lack of ornament, this is nowhere more noticeable than in the pillows. A characteristic specimen of a Funafuti head-rest is shown by fig. 59. It is a rough hewn, unsymmetrical, slightly bowed



Fig. 59.



Fig. 60.

slab, supported by two rough, crooked legs, carved in one piece. It is of a hard heavy wood, in parts highly polished by use; its weight is three pounds; length twenty, breadth three and a half, and height five inches. Another specimen is more ornate and symmetrical, consisting of a flat board supported by two horse-shoe legs. This (fig. 60) is of a hard wood, probably *Calophyllum*, weighs one pound fourteen ounces, is fourteen inches long, five wide and four high. The more graceful design of this article suggests to me that it may have been made by a native of another archipelago.

In use these articles are not so uncomfortable as an untravelled observer might imagine. For in a hot moist climate the constant perspiration renders a soft, absorbent pillow less acceptable than a cool, smooth, though hard, surface. Besides, sleeping on his back, the Polynesian does not rest his cheek, like the European, but the back of his head, on his pillow.

On Vaitupu, Bridge* noticed couches carved out of single pieces of wood, with four legs, and a solid block like a pillow at one end.

Under the regime of the Native Teacher every effort is made to Europeanise the Polynesian. If, after cricket and football, the pupils be introduced to the English schoolboy's "pillow fight," serious consequences would ensue.

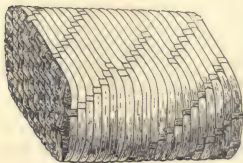


Fig. 61.

Though upon Funafuti the mat cushion did not seem to be employed, it was well known there, and a model of it was made for a member of our party. On Nukulailai, however, I found them in common use. A well-worn specimen procured there is shown by fig. 61. It is formed of woven pandanus leaf, weighs one pound ten ounces, is nine inches long, six high, and four thick.

* Bridge—Proc. Roy. Geogr. Soc., viii., 1886, p. 554.

The cushion pillow seems less widely distributed than the wooden head-rest. From Tahiti, Edge-Partington notes a "pillow of plaited leaf."* Of Hawaii:—"It is said that wooden pillows were used in olden times, but if so there are none in this collection [the Bernice Pauahi Bishop Museum]. The Hawaiian pillow is a parallelopipedon of plaited pandanus leaves, stuffed with the same material, capital accompaniment to the Hawaiian mat bed."†

FLASKS.

Pottery, strange to any section of the Polynesian people,‡ was of course absent from the Ellice Group, for not only was the potter's art unknown but his raw material does not even occur there. Neither do gourds (*Lagenaria*), so serviceable to natives of other Pacific islands, grow in this archipelago. The Ellice Islanders are therefore restricted in the choice of vessels capable of containing fluids to sea-shells, wooden bowls, and coconut shells. The latter, known as "vei'i," are of a handy size and weight, and for convenient portability are often fitted with sinnet casing and handle. Considerable variation exists in the net-work, which in some cases, foreign to the Ellice, is so close as to conceal the surface of the flask.§ Particularly large nuts are especially valued for flasks, and are prepared by stripping off the fibrous husk down to the hard shell; the contents are abstracted by breaking in one "eye," placing the nut in salt water till the kernel decays, and rinsing out the shell. A stopper is readily improvised from a rolled strip of banana or pandanus leaf. The original of fig. 62, from Funafuti, weighs when empty, fifteen ounces, contains three and a half pints, and is eight inches in major diameter and six in minor.



Fig. 62.

Flasks are shown on p. 25 receiving toddy. Gill published a sketch of a girl drawing water with one at Vaitupu, as described on p. 60.||

* Edge-Partington—*loc. cit.*, i., pl. xxxiii, fig. 8.

† Brigham—*loc. cit.*, p. 33.

‡ Cook particularly remarked of some earthenware that he saw in Tonga, "that it was the manufacture of some other isle." (Second Voyage, i., 1777, p. 214).

§ Gourds, as shown by the frontispiece of Erskine's "Cruise in the Western Pacific," 1853, are likewise sometimes mounted with net-work.

|| Gill—*Life in the Southern Isles*, 1876, p. 141.

BOXES.

The natives of Funafuti use carved wooden box-tubs to hold food, fish-hooks, tobacco, or other small articles when on a canoe journey or a fishing excursion. In travelling these are stowed forward or aft under the decking, but when at anchor fishing, are frequently hitched by the cord over a thwart within reach of the fisherman. The lids with which these are fitted close so tightly as to keep the contents dry even if the canoe be swamped with water. The lid is so strung that it can be raised and slipped over the box, but not entirely detached. In shape and size these box-tubs have a general resemblance to the familiar "billy," of the Australian bushman.

Captain Hudson observed on Fakaafu :—"Boxes or buckets of various sizes, from the capacity of a gill to that of a gallon; they are cut out of the solid wood, and the top or lid is fitted in a neat manner. These are used to keep their fish-hooks and other small articles in to preserve them from the wet."*

One of these box-tubs is figured with details by Edge-Partington as from Samoa; he writes of it :—"Box and cover of pale wood, stout plaited cord. Labelled, 'a provision-tub, to be carried under the canoe in the water,'"[†] which label is obviously absurd. There are numerous references in literature to the wooden boxes of the Polynesians, but I have not noted any other than the foregoing sufficiently full to distinguish the type under discussion from other forms of boxes, for example, the lavishly decorated caskets of the Maoris, occurring in the Pacific.

Three expressions of the box-tub were secured on Funafuti, where the article is known as "tourouma." The largest specimen in the collection weighs three pounds eight ounces, and has a capacity of a hundred and forty-one cubic inches, stands seven inches high, and is nine inches in basal diameter; like the rest of the series, it appears to be made of *Calophyllum* timber. In general it so closely corresponds with the illustrations above-cited from the Ethnographical Album that it is not necessary to draw it; from the Samoan specimen it differs in a less number of feet, possessing but ten equally spaced triangular supports, of less breadth than their interstices.

The lid is secured in a particularly ingenious way, it is "rabbeted on" so that the rim of the lid is outside flush with the wall of the box and inside fits against the flange of the box. The latter being slightly undercut, it is necessary to press the cover home. The lid only shuts in one position, and when down can be more securely fixed by slightly rotating it. The other specimens close in a simpler manner, so that it is possible that the shutting

* Wilkes—*loc. cit.*, v., p. 18.

† Edge-Partington—*loc. cit.*, ii., pl. xl., fig. 8.

of the largest box is more a matter of accident than of design. This box is further exceptional in having a square piece of wood neatly let into the centre of the floor. Probably the tree which furnished the material was decayed at the core, and it was thus that the defect was remedied.

Two similar specimens vary from the foregoing in having no supports beneath, and no cleat on the summit of the lid. Instead the lugs on the box are continued into a pair on the lid, which latter is perfectly flat above. Both pairs are pierced by holes which continue from the lid through the box and through which a cord of *Broussonetia* is rove, these lugs serve therefore as running cleats. The taller box-tub is drawn on fig. 63 as open and closed, with the under aspect of the lid apart; the closed one is seen to be fastened in the native fashion by twisting the cord round the side. It is seven inches high, six and a half in basal diameter, weighs two pounds, and has a capacity of ninety-seven cubic inches, the sides are straight but the bottom is somewhat rounded. The other specimen differs in proportions and in having a flat base. It is five and three-quarter inches both in height and in basal diameter, and five and a half inches in least diameter across the lid, weighs one pound fifteen ounces, and contains fifty-nine cubic inches.

A third form of tourouma, shown by fig. 64, is intermediate in features between the others. It has a central running cleat on the lid like the first described, but those on the box are set half-way down the side and at right angles to those previously considered. The base is fairly flat and without feet. The lid has without a bevelled edge, and within a central excavation and a sub-marginal groove to receive the flange of the box. This box-tub is taller in proportion to breadth than the others and also tapers more upwards. From base to top of cleat is eight inches, the base is six and a half inches in diameter, and the top five and a half. It weighs one pound eleven ounces, and holds seventy-five cubic inches.

WOODEN DISHES.

These necessary and valued utensils are possessed by every household and are made in diverse sizes and shapes. The absence

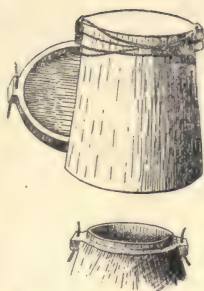


Fig. 63.



Fig. 64.

of ornament, so marked a feature in all the appurtenances of the Ellice Islanders, is again obvious in surveying the bowls. The fanciful carving which other Pacific people delight to lavish upon these receptacles, is here totally wanting.



Fig. 65.



Fig. 66.



Fig. 67.

A wooden dish of an uncommon pattern is the "babanak," shown by fig. 65, the name of which suggests to me a Micronesian derivation. This article is rudely circular, with outwardly sloping wall, ending in a lip. It weighs one pound thirteen ounces, stands four and a half inches high, is twelve and a half inches in diameter above and seven inches across the base. The rim is half an inch thick, three-quarters wide, and projects half an inch from the wall.

The common food bowl of which fig. 66 is an instance, is here known as "kumiti," a name which seems to be associated with this article from Samoa to the Solomons. The specimen of this before me is an elliptical trough, tapering to lugs at either end, standing on a flat base of half the total length; it weighs two pounds nine ounces, stands three and a quarter inches high, is nineteen and a half inches long, and nine and a quarter wide. Another form of kumiti, larger and without lugs, is shown on p. 28, employed as a tank.

A wooden mortar, in which taro or coconut is pounded for cooking, is called "kumiti tuki." Except that it is elliptical rather than circular, the shape is that of the European equivalent. This form is here exemplified by a specimen (fig. 67) apparently of *Calophyllum* timber, weighing six pounds, eight inches high, excavated to a depth of six inches, at the aperture twelve inches by ten, and at the base eight by seven.

PESTLES.



Fig. 68.

Pestles for mashing taro and coconut form part of the equipment of every kitchen. A pattern called "jini" is exemplified by fig. 68. It is unsymmetrically ovate, truncate at the broad end and surmounted by a knob, which is much chipped in our example, at the opposite end. It is of a hard heavy polished wood, perhaps *Thespesia*, weighs three pounds six ounces, is ten inches long, and five and a quarter broad at its greatest diameter.

Another pounder (fig. 69) is eighteen inches long, straight, tapering from two and a half inches at the butt to half an inch at the opposite end. A pagoda-shaped handle is formed by incised carving of the final four inches. It is one pound ten ounces in weight, and made, I think, of *Pemphis* timber.

A third form is drawn at fig. 70. This, called "tuki tuki," is club-shaped, two feet seven and a half inches long. At one end the diameter is three and three-quarter inches, at the other an inch and a half. The weight amounts to five pounds eight ounces. This form was used standing, but the lesser pestles were used sitting.



Fig. 70. Fig. 69.

DRUM.

Two radically distinct types of drum, each with numerous variations, co-exist in the Pacific. The one which seems to attain its greatest development in Papua is akin to the European drum, consisting like it of a skin tympanum stretched on a wooden cylinder. The other and ruder form is more characteristic of Polynesia, it consists merely of a boat-shaped, hollow log, beaten on the exterior.

The drum, "batti," of Funafuti (fig. 71) belongs to the latter division. Formerly it was used at dances and festivals, now it appears only to summon the worshippers to church,* and the only specimens on the island seemed to be those in the possession of the Native Teacher. A well-worn example I obtained from him weighed four pounds four ounces, and measured nineteen inches in greatest length, four and a half in depth, and three and a half in width. The excavation is three and a half inches deep, twelve long, and one and a half wide. The drum-stick, "kouta," weighs four ounces, and is ten inches long, and one thick. In another example, the drum was carved of *Thespesia* and the stick of *Pemphis* wood.



Fig. 71.

To call the people together to a trial or other public ceremony, a shell trumpet of *Cassis cornuta* was blown.

LANCETS.

For bleeding, and for lancing boils, etc., the native surgeons make use of shark's teeth set in wooden handles. I procured on Nukulailai two old, worn and stained specimens, measuring seven and a half and six inches, and weighing 3.55 and 3.54 grammes

* As in the Tokelau Islands, Lister—loc. cit.

respectively. A piece of wood, somewhat the size and shape of an ordinary penholder, is split at its extremity for an inch, into which a small shark's tooth is inserted and bound in the cleft, by cotton in one case and by native fibre in another.



Fig. 73. Fig. 72.

On Funafuti I failed to purchase original specimens, though such were in existence at the time of our visit. Models were, however, made for me, larger and rougher than the Nukulailai specimens. The serrate-toothed lancet, from the jaw of *Galeocerdo rayneri* (fig. 72) for bleeding, is called "nifikifa"; the straight-edge tooth lancet from *Carcharias lamia* (fig. 73), for puncturing, is known as "bunga."

These instruments were described to me as used like a tattooing pen, that is, the handle was held in the left hand so that the point of the tooth was placed just over the spot to be punctured, then the handle was smartly tapped by a stick held in the right hand and the point driven in. Dr. Collingwood writes:—"The tooth of the instrument is placed over the abscess, and with one blow it is forced into the cavity of the same, while there the extremity of the handle of the lance is made to pass through a semicircle, with the result in a skilful hand an elliptical piece of flesh is removed, thereby preventing the two rapid closure of the wound."*

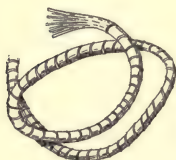


Fig. 74.

In Tahiti, "they were clever at lancing an abscess with the thorn from a kind of bramble or a shark's tooth."†

Fig. 74 shows a roll of prepared bark of the vala-vala (*Premna taitensis*) used in cauterization, as mentioned on p. 37.

In Hawaii the skin was scorched with fire-brands in times of mourning.‡

In Japan, "moxa, or the burning of a small cone of cottony fibres of the *Artemisia*, on the back and feet, was practised as early as the eleventh century, reference being made to it in a poem written at that time."§

* The *Tasmanian Mail*, 6th March, 1897, p. 34.

† Ellis—*loc. cit.*, iii., p. 44.

‡ Ellis—*loc. cit.*, iv., p. 181.

§ Griffis—*The Mikado's Empire*, 1887, p. 207.

FIRE STICKS.

Almost without exception fire has been obtained by all primitive people by the rubbing together of pieces of wood. In detail, however, the process differs greatly among different races.

Among Australian Aborigines the usual method was to press and twirl between the palms a perpendicular rod in a hole in a fixed horizontal stick.* The ancient Egyptians, likewise, rotated a perpendicular upon a horizontal stick, but employed a bow to revolve the upright.

Another method, approaching more closely to the form we are about to consider, is the fire-saw used in Borneo and Australia under several forms,† the general principle of which consists of sawing an edged rod in a notched one.

Throughout the Pacific Islands one method, and, as far as I am aware, only one is employed, that of ploughing a wooden blade in a groove. It is thus described by Woodford in the Solomons:—“A stake of dry, soft wood is selected, a convenient size being about as thick as the wrist. For convenience a few chips are sliced off in one place to make a flat surface to rub upon. The stake is then placed upon the ground in front of the operator, who sits on one end of it and holds it steady between his toes, then with a pencil-shaped piece of harder wood, held firmly in both hands, he begins rubbing up and down upon the flat surface. A groove is formed and a dark coloured dust soon produced, which is pushed to the farther end of the groove. The dust before long begins to smoke. The pace is increased, and it begins to smoulder. A piece of dry touchwood is then applied to it and quickly blown into a glow. With perfectly dry wood a native will almost certainly produce fire in less than a minute.”‡

Though the general process has been repeatedly described, the exact method of gripping the stick with the hands has not, I believe, been explained.§ The crossed thumbs are placed beneath the stick, the flexed fingers of one half-opened hand are placed above it, and upon them are laid the fingers of the other hand, this posture (fig. 75) allowing the operator to lean the whole weight of his body on the stick, while rapidly moving it to and fro, at about half a right angle to the grooved stick. In an example from Funafuti before me, the blackened groove is three and a half inches

* For details and figures see Brough Smyth—*Aborigines of Victoria*, i., 1876, p. 392, figs. 231, 232.

† Roth—*The Natives of Sarawak and British North Borneo*, i., 1896, p. 377, fig.; and Brough Smyth—*loc. cit.*, p. 395, figs. 223, 224.

‡ Woodford—*A Naturalist among the Head-hunters*, 1890, p. 161. See also Lamont—*op. cit.*, p. 156.

§ Since writing this, an excellent figure and description of the process by Lieut. B. T. Somerville, R.N., (*Journ. Anthropol. Inst.*, xxvi., 1897, p. 376, pl. xxxv.), has reached me.



Fig. 75.

long, a third of an inch wide, and an eighth of an inch deep. The flattened surface cut for its reception is five inches long and one-half inch broad. The stake, "kousikanga," of dry *Premna taitensis* chosen, was originally about six feet long and an inch and a half in diameter. The wooden knife "koufataronga" used on it is of another timber, nine inches long, one wide, and half an inch thick,

obliquely truncated at the worn end.

In Hawaii, "a smaller stick, the *aulima*, is held in the hand and rubbed in a groove in a larger stick, the *ahunaki*."*

The reverence, amounting almost to fire-worship, paid to fire by different settlements of the Tokelau people, is related *ante* p. 55.

TOYS.

A game formerly played on Funafuti, but which is not now practised, was that of throwing a toy dart. I have gathered a few references to this game as played elsewhere in the Pacific, but further literary search would probably widen the known range.

Captain Erskine has thus described the game as he saw it played in Fiji†:—"On our return to the Mission house we met a number of men in full dress, that is, painted either black or red, their hair frizzed out, and decorated with blue beads, some wearing garters or bands tied in bows under the knee, and a few with a kilt or petticoat, resembling that of the women. Each carried a short cane, with an oblong, pear-shaped head, forming a kind of blunt dart, with which a game called "tika," or "titika" is played. We followed them to the spot, which presented a very gay scene, a hundred or so of persons being assembled at the sides of a level, well swept mall, about one hundred and fifty yards long, and five or six wide, skirted with trees and shrubs. Each player advanced in turn, and threw his dart at a mark placed at the end of the mall, but none of them exhibited much skill, nor did the game seem to us one of any interest, and all were quiet and decorous."‡

On the authority of Dr. Turner, Edge-Partington publishes from Niue a "head of a dart used in a game," which closely resembles the one before me.§

* Brigham—*loc. cit.*, pt. ii., p. 31.

† Erskine—*Journal of a Cruise among the Islands of the Western Pacific*, 1853, p. 169.

‡ Another description of the game in Fiji is given by the Rev. J. G. Wood—*Natural History of Man*, ii., 1870, p. 283. In the *Journal of the Godeffroy Museum*, iv., 1876, pl. xvi., fig. 1, a player is drawn in the act of casting his dart, "ulutoa." The attitude is the same shown me on Funafuti.

§ Edge-Partington—*loc. cit.*, i., pl. xxxix., fig. 1.

In the Banks Island and the New Hebrides "the game is played by two parties, who count pigs for the furthest casts, the number of pigs counted as gained depending on the number of knots in the winning tika. There is a proper season for the game, that in which the yams are dug, the reeds on which the yam vines had been trained having apparently served originally for the tika. When two villages engage in a match they sometimes come to blows."*

Ellis also describes this game from Tahiti and Hawaii.† Gill has given a chant from the Hervey Islands for a reed throwing match for women.‡

Dr. Gill notes in his Diary that it was formerly the custom on the island of Nanomana, Ellice Group, that "when a young man wins a reed throwing match, his own sister testifies her joy by coming into the assembly stark naked and clapping her hands."

A model of this toy made for me by an old native of Funafuti, is represented by figs. 76 and 77. The entire article is called "jiga," and the separate head is "urotoa." The stem is a light rod of *Scaevola* wood, an ounce in weight, three feet in length, and half an inch in diameter; the head, perhaps modeled from a whale's tooth, is of *Pemphis* wood, a cone whose truncated base is produced into a spike, carved in one piece, in weight four ounces, in total length eight inches, the spike being a third thereof, and in greatest breadth an inch and a half. It is mounted by thrusting the spike home into the soft pith of *Scaevola* rod.

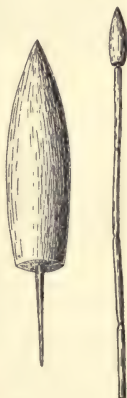


Fig. 76. Fig. 77.

Another toy consisted of a cube of plaited pandanus leaf, served as a light ball, with which, on the beach, groups of girls amused themselves by tossing to each other and catching. A specimen of the "anou," as this is called on Funafuti, is shown by fig. 78, it weighs three-quarters of an ounce, and measures two inches cube.

From Ruk, in the Carolines, the Bernice Pauahi Bishop Museum possess a "cube of plaited pandanus leaf used as a ball."

Ellis has described a game, "haru raa puu," played by the Tahitians with a large ball of the tough stalks of the plantain leaves twisted closely and firmly together.§

* Codrington—The Melanesians, 1891, p. 340.

† Ellis—Polynesian Researches, i., 1836, p. 227; iv., p. 197.

‡ Gill—Myths and Songs, 1876, p. 179.

§ Ellis—loc. cit., i., p. 214.

At Simbo, in the Solomons, Mr. N. Hardy tells me he saw a globular leaf ball tossed from hand to hand.

Spinning tops I found to be a popular amusement on Nukulailai. Their tops were simply cone shells (*Conus hebraeus* and *C. pulicarius*) spun on their apices. A game was to spin two shells into a wooden dish out of which by rotating and colliding the winner would knock the loser. The shells were spun either like a teetotum between the finger and thumb, or, to give greater force, the anterior end was steadied by the finger and thumb of the left hand, while the impetus was given by drawing the right forefinger briskly across it, as shown in fig. 79. A shell of *C. hebraeus* I purchased, the broken lip of which betokened much service, was called "vaitalo."



Fig. 78.



Fig. 79.



Fig. 80.

On Funafuti, a sort of toy windmill was contrived by plaiting four arms of palm pinnule, mounting this on a stand of palm riblet, and thrusting the latter into the sand. The wind would then rotate the arms. This toy, called "bekka," is shown at fig. 80.

Mr. J. S. Gardiner tells me that he saw this toy windmill in Rotumah, and it has been lately recorded from the Solomons by Lieut. B. T. Somerville, R.N.*

ADDENDUM.

Sandals.—Since revising the preceding pages (243-4) dealing with the Pacific sandal, I have seen a figure and description of an interesting sandal of *Cordyline* fibre from New Zealand by Mr. O. T. Mason.† Another article is thus added to the long list of those common to every main division of the Polynesian Race. It is interesting also to note that this Ethnologist detects in the border loops for the lacing a similarity between the Polynesian and a Korean pattern.

* Journ. Anthrop. Inst., xxvi., 1897, p. 409.

† Mason—Primitive Travel and Transportation, Report U.S. National Museum, 1894 (1896), p. 315.

EXPLANATION OF PLATE XIII.

Method of putting on a "tukai" dress.



EXPLANATION OF PLATE XIV.

Method of scraping coconut with the "twaikarea."



EXPLANATION OF PLATE XV.

- Fig. 1. A canoe from Funafuti.
„ 2. Stem of another specimen.
„ 3. Stern of another specimen.
„ 4. Fishing rod in position.
„ 5. Divisible outrigger for detaching float.
„ 6. Float perforated for fastening to outrigger.
„ 7. Float pegged for fastening to the outrigger.
„ 8. Bailer.
„ 9. Paddle.



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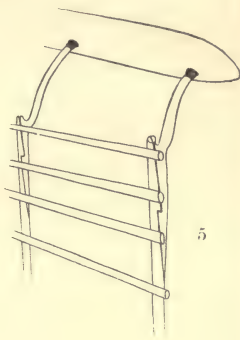
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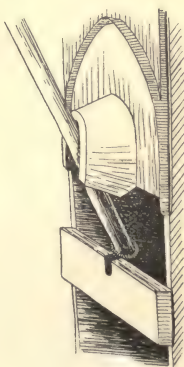
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THE ALCYONARIA OF FUNAFUTI.

PART II.

BY THOMAS WHITELEGGE.

Zoologist, Australian Museum.

[XII.]

THE ALCYONARIA.

Part II.

By THOMAS WHITELEGGE,
Zoologist, Australian Museum.

The collection of *Gorgonidæ* made by Mr. C. Hedley, although small in number, is particularly interesting from the fact that, of the ten species obtained, eight prove to be new.

Included in the collection is a number of noteworthy forms belonging mostly to genera containing but few species.

The species described as new are as follows :—*Keroeides gracilis*, *Acanthogorgia breviflora*, *Anthomuricea simplex*, *Villogorgia flagellata*, *Bebryce Studeri*, *Muricella purpurea*, *Nicella laxa* and *Verucella flabellata*. Six out of the eight genera above mentioned, have not previously been represented in the Museum collection.

The wealth of the Pacific Ocean in *Gorgonidæ*, indicated by the Challenger Report, has been further emphasized by the investigation of the Funafuti fauna.

The result of these studies has been to enlarge genera hitherto only represented by one or two species ; thus, another species has each been added to the monotypic genera *Keroeides* and *Nicella*, the former inhabiting the coast of Japan, the latter that of Mauritius. *Anthomuricea* and *Bebryce* have each been increased by an additional species.

The whole of the specimens with two exceptions (*Plexaura antipathes* and *Heliopora*) were obtained by tangles on the outer reef, at a depth of from 40 to 70 fathoms.

Mr. Edgar R. Waite has again favoured me with the drawings from which the accompanying plates have been reproduced.

The following notes have been supplied by Mr. C. Hedley :—
“Dead specimens of the *Heliopora* were abundant, a raised bed of it indicating upheaval is described, *ante* p. 11. Numerous colonies, each extending over many square yards were seen in two or three fathoms depth on the lagoon coast of the main islet, but on procuring pieces by the aid of a native diver, they always proved to be dead, having perhaps been smothered by shifting

sand. Dead fragments of this genus were also common on the beaches, yet it was only once encountered by any of our party alive, in which state it was dredged off the South-West Entrance. On Nukulailai, however, I noticed living *Heliopora* in abundance at low water mark at the Boat Entrance.

"The *Plexaura* was restricted, as far as my observations went, to one situation, the lagoon side of a "passage" (*vide* p. 18), where I saw it on both east and west sides of the atoll. It grew in large bushes four feet high and a yard in diameter, in two or three fathoms of water. Numerous *Avicula* attached to these suggested a flock of small birds perching on the twigs."

Order ALCYONACEA.

FAMILY HELIOPORIDÆ.

HELIOPORA COERULEA, Pallas.

Heliopora coerulea, (Pallas) Blainville, Manuel d'Actinol., p. 392, pl. lxi. fig. 3.

Mr. C. Hedley informs me that he only once obtained *Heliopora* alive at Funafuti, but that dead specimens were abundant, both cast up on the beach and *in situ* in the lagoon.

It was also observed in a semifossil condition in a raised reef near the centre of the islet. On the island of Nukulailai it was seen alive in profusion at the boat landing.

Order GORGONACEA.

SECTION SCLERAXONIA.

FAMILY SCLEROGORGIA.

KEROEIDES GRACILIS, sp. nov.

(Plate xvi., figs. 1 - 5.)

This species is represented by four fragments, of which the largest is 50 mm. in height, and 30 mm. in breadth, the main stem is 2 mm. in diameter. Near the base it bears four simple branches, which are alternate, in one plane, and at very unequal distances apart; the largest branch is 30 mm. in length and 1 mm. in diameter.

The polyps are small and roundly conical in shape, from 4 to 6 mm. in height, 1 mm. in diameter at the base, and .6 to .8 mm. at the summit, they are placed on the sides of the stem and branches alternately, those on the latter are inclined towards one side of the plane of branching, their apertures being visible from the front only.

The cœnenchyma is thin, smooth, without external grooves, and densely charged with large closely tuberculate spindles.

The axis consists of a series of long spicules firmly cemented together, its diameter near the base is .9 mm., the terminal twigs .1 mm.

The spicules of the cœnenchyma are straight or but little curved spindles, closely beset with either simple or compound tubercles. On and in the neighbourhood of the verrucae they are very irregular in shape, placed transversely and frequently adapted to each other, having one or both ends obliquely truncated, and including such forms as the following: elongate triangles, clubs, boomerangs and short bent spindles. By transmitted light they are of a bright brick red colour.

The retracted polyps are covered by a series of short, straight, or curved spiny spindles, of a pale pink or white colour; there are a number of spicules embedded in the tentacles, which have a few blunt spines and acutely-pointed ends.

The spicules are as follows:—

(1.) Large almost straight tuberculated spindles. Size—1. by .15, 1. by .25, 1.2 by .35, 2. by .3 mm.

(2.) Irregular shaped spicules of the verrucae. Size—.3 by .15, .3 by .1, .4 by .15, .5 by .25, .6 by .25, 1. by .35 mm.

(3.) Operculate spicules. Size—.2 by .02, .25 by .03, .25 by .05 mm.

(4.) Tentacle spicules. Size—.1 by .01, .2 by .02 mm.

(5.) Spicules from the axis. Size—.3 by .02, .5 by .04 mm.

The colour is bright coral-red, the polyps are yellowish-white.

This species differs from *Keroeides koreni* in its erect non-pendulous habit and in the characters of its spicules.

SECTION HOLAXONIA.

FAMILY MURICEIDÆ.

ACANTHOGORGIA BREVIFLORA, sp. nov.

(Plate xvi., figs. 6–10.)

A small, broken and almost denuded colony, 52 mm. in height. Arising from an enlarged base, the stem at a height of 5 mm. divides, giving off two branches, of which the smaller is 20 mm. in length and bears a simple branchlet, the larger is 47 mm. in length and bears three simple branchlets at equal distances apart, the longest being 20 mm.; there are indications of four other branchlets, they are, however, broken off quite close to the main branch. The mode of branching is alternate and in one plane, the axis is

horny but rather brittle, at the base it is 1 mm. in diameter, the branches varying from .5 to .7 mm. The colour is blackish-brown, the extremities of the branchlets are yellowish-brown.

The polyps arise at right angles and are arranged on the sides of the branches alternately, they are wider at the apex and base than in the middle, measuring 1. to 1.5 mm. in height, .7 to .9 mm. in diameter, and occur at intervals of from 1. to 5. mm.

The coenenchyma of the stem is extremely thin, and of a yellowish-white colour, the spicules are few and wide apart, the axis being visible through the tissues.

The spicules of the coenenchyma are straight or curved, spindles longitudinally arranged, with acute points and a few distant blunt spines.

Size—.3 by .05, .5 by .04, .7 by .05 mm.

The polyp spicules are arranged transversely at the base in oblique rows on the sides, but not so distinctly seriate as in other species of the genus; at the base of the tentacles they are peripheral, and the apex is surmounted by a series of long needle-like spicules with a simple strongly bent or a bifurcated base. The surface spicules are distantly spiny or tuberculate, those deeply seated are often quite smooth. The spicules of the base and sides are curved spindles, with a few blunt spines near the ends and occasionally tuberculate in the middle. Size—.5 by .05, .65 by .04, .8 by .06 mm. The deep-seated spicules are curved or bent, rarely straight, smooth or with faint indications of spines. Size—.3 by .03, .5 by .04, .7 by .03 mm. The coronal spicules have the long free end smooth, the stout basal portion is strongly tuberculate and either simple and angularly bent or bifurcated. Size—.5 by .08, .6 by .07, 1. by .07 mm. The tentacle spicules are short curved rods or spindles with a few strong blunt spines, which are often large and prominent on the convex sides. Size—.2 by .02 mm.

Colour in formol is yellowish-white.

This species may be distinguished from other species of the genus by its small polyps and large spicules.

ANTHOMURICEA SIMPLEX, sp. nov.

(Plate xvi., figs. 11–15.)

A small broken and evidently unbranched specimen is here referred to this genus. The stem arises from an enlarged base, measures 35 mm. in height, judging by the fragments its original height must have been between 60 and 70 mm., the lower portion is a little flattened, the upper cylindrical, it exhibits two subequal curves in opposite directions, and is uniformly 2 mm. in diameter.

The polyps arise at nearly right angles, some are inclined towards the base and others towards the summit, they occur at intervals of from 2 to 3 mm.; on the lower half of the stem they alternate on opposite sides, on the upper they tend to become subspiral; they are cylindro-conical in shape, and are from 2 to 4 mm. in height and 2 mm. in diameter. The apical portion of the stem terminates in a pair of opposed polyps, with a short blunt process at the apex.

The axis is horny, but rather brittle and of dark yellow colour.

The cœnenchyma of the stem is densely packed with large tuberculated spindles, which are generally longitudinally disposed, but they are frequently oblique or even transverse near the bases of the polyps, and they are often bent and adapted to the stem.

The verrucæ are clothed externally with a thickish layer of spicules, differing little except in size from those of the stem, there are a few placed transversely or obliquely at the base, whilst those above are arranged longitudinally side by side, the points of the upper ones projecting slightly beyond the margin, beneath this exterior layer of spicules, are others much smaller, arranged transversely at the base, and obliquely or longitudinally towards the summit.

The polyps are mostly retracted within the verrucæ, in some few instances they are exerted, the conical polyp heads standing out beyond the margins of the verrucæ and exhibiting a narrow neck beneath the collar, devoid of spicules externally.

The collar is composed of a narrow ring of curved spicules, with smooth blunt ends and a few low tubercles in the middle. Above the collaret there are a series of spicules arranged *en chevron* forming an eight-rayed operculum, their upper fourth is closely tuberculate, their lower three-fourths either smooth or with low tubercles; their fixed ends are bluntly rounded, their free ends tapering to not very acute points.

The tentacles have on their dorsal surfaces numerous curved spicules, arranged *en chevron*.

The spicules of the cœnenchyma are as follows:—

(1.) Large straight or curved spindles, thick in the middle, tapering to long acute points, and closely covered with warty tubercles. Size—1 by .2, 1.5 by .23, 2 by .25, 2.5 by .4, .4 by .45 mm.

(2.) Large club-shaped, with the thick end rounded, obliquely truncated, or suddenly tapering to an acute point, and with the narrow end sharply pointed, tubercles as in No. 1. Size—1.5 by 2.5, 1.7 by .25 mm.

In addition to the above, two crosses have been observed, one equal rayed and similar to the larger spicules, the other resembling the smaller polyp spicules.

(1.) The external spicules of the verrucæ are similar to but smaller than those of the stem. Size—1· by ·15, 1·5 by ·2, 2· by ·2 mm.

(2.) Smaller deep-seated fusiform spicules, with distant tubercles or low spines, rather numerous in the verrucæ, particularly at the base. Size—·5 by ·08, ·8 by ·1, 1· by ·15 mm.

(3.) Curved collar spicules, with the ends smooth and rounded, the central region with a few distant blunt spines or low tubercles. Size—·7 by ·1, ·8 by ·12 mm.

(4.) The spicules of the operculum consist of a larger external, and of a smaller internal series, the larger are tuberculate, fusiform or subclavate with the free ends acute and the fixed ends blunt. They measure ·6 by ·08, ·7 by ·09, and ·8 by ·1 mm.; the smaller are slightly curved fusiform or subclavate, with either acute or blunt ends and a few distant tubercles. Size—·25 by ·05, 4· by ·08 mm.

(5.) The tentacle spicules are very numerous, and consist of straight, curved, or bent rods, with faint indications of spines, they are imbedded in the tissues and may be traced below the collar, probably in the apices of the inverted tentacles.

All the spicules except the last-named, which are colourless, are of a dark brick-red by transmitted light.

There are no traces of spicules of the form called "stachel-platten" by Kolliker.

The colour in formol is purplish-red.

This species differs from *A. chæmelon* and *A. argentea* by the larger size of the polyps and spicules.

VILLOGORGIA FLAGELLATA, sp. nov.

(Plate xvi., figs. 16–20.)

There are seven fragments all more or less denuded owing to their being entangled in the tow, one is attached to the dead stem of a species of *Verrucella*.

The largest specimen is 95 mm. in height and from 15 to 20 mm. in width, it is flattened in a plane opposite to that of the branching, the stem is ·7 mm. in diameter, the branches are lateral, opposite or alternate, simple or bearing long slender thread-like twigs. The axis is horny, yellowish, the branches and twigs are flexible the base of the stem rather brittle. When viewed by transmitted

light under the microscope it presents an appearance like the axis of *Plexaura flavida*.*

The polyps are alternate or often in pairs on opposite sides, especially at the summits of the slender twigs, they occur at intervals of from $\cdot 5$ to $1\cdot$ mm. they are $\cdot 5$ to $\cdot 6$ mm. in diameter, and from $\cdot 7$ to $\cdot 8$ in height, in shape they are roundly conical, on the stem and branches, whilst the terminal ones are usually cylindrical.

The cœnenchyma is very thin, the branches are encircled by a single layer of quadriradiate spicules, the rays are frequently at right angles to each other, they are bent down in such a manner as to embrace the stem, the upper central ray is produced and projects through the cœnenchyma, giving the stem and branches a spiny outline.

The external spicules of the verrucæ are triradiate, the upper ray being long and spine-like, and project through the tissues, at angles varying from the horizontal to the perpendicular, the lower rays are imbedded in the cœnenchyma and are very variable in shape, in some cases they are simple tuberculated spines, in others the spines are distinct but they are connected by a perforate plate, or the spines may give place to a many rayed perforate plate, beset with minutely beaded tubercles.

The summits of the verrucæ are surmounted by a series of long acute spicules, resembling those of the walls but having the projecting ray longer and the imbedded portion more strongly but irregularly developed.

The tentacles have at their bases externally a few irregular curved spindles, with a minutely granular and tuberculated surface, on the convex side near their free ends, they are usually provided with three or four teeth-like processes; similar but smaller spicules exist in the tentacles, the denticles often projecting at their apices.

(1) The quadriradiate spicules of the cœnenchyma have acute points and a few blunt spines, they measure in their widest diameter $\cdot 15$ by $\cdot 2$ mm., they are from $\cdot 1$ to $\cdot 15$ mm. in height, the rays are from $\cdot 07$ to $\cdot 1$ mm. in length and $\cdot 03$ mm. in diameter, the apical spines are from $\cdot 03$ to $\cdot 1$ mm. in length.

(2.) The triradiate spicules of the verrucæ measure in their widest diameter from $\cdot 15$ to $\cdot 35$ mm., their height is from $\cdot 15$ to $\cdot 3$ mm., the free acute ray is from $\cdot 1$ to $\cdot 2$ mm. in length and $\cdot 05$ mm. in diameter.

(3.) The apical spicules of the verrucæ are from $\cdot 3$ to $\cdot 5$ mm. in height, and from $\cdot 2$ to $\cdot 4$ mm. wide at the base, the free spine being $\cdot 15$ to $\cdot 25$ mm. in length and $\cdot 05$ mm. in diameter.

* Kolliker—Icones Hist., ii., 1866, pl. xii., fig. 5.

(4.) The irregular curved operculate spicules are from .15 to .25 mm. in length, and from .05 to .1 mm. in diameter at the free dentate end.

(5.) The tentacle spicules are curved, acute at one end and dentate at the other, the teeth being generally confined to the convex side, they are from .05 to .1 mm. in length.

Colour in formol is yellowish-white.

Villogorgia flagellata is distinguished from other species of the genus by its slender whip-like branches, and by its single layer of quadriradiate spicules.

VILLOGORGIA INTRICATA, Gray.

Brandella intricata, Gray, Cat. Lithophytes Brit. Mus., 1870, p. 30, fig. 8; Ridley, Ann. & Mag. Nat. Hist., ix., ser. 5, 1882, p. 188.

One specimen, 120 mm. in height and 70 mm. wide, the axis is dark brown at the base, the branches light yellowish-brown, the polyps and cœnenchyma are creamy-white.

BEERYCE STUDERI, sp. nov.

(Plate xvii., figs. 21 - 25.)

Of this species only one small specimen is available, the base is wanting and some of the smaller branches are broken off.

The stem is 60 mm. in height and 1.5 mm. in diameter. The branches are in a plane, alternate and generally at right angles to the stem; there are four lateral branches, situated at irregular distances apart, three of which bear one or two branchlets, these in turn bearing very short twigs.

The axis is horny, the main stem dark brown, the branches yellowish-brown.

The polyps are alternate, rarely opposite, and arranged in rather loose irregular spirals round the stem and branches, at the extremities of the twigs there are usually a pair placed on opposite sides, which are slightly larger than those on the rest of the colony.

The polyps form low rounded elevations from .3 to .7 mm. in height, and from .8 to .1 mm. in diameter, and from 1 to 4 mm. apart.

The cœnenchyma is thin, grayish-white in colour, and has a finely granular appearance under a moderate magnifying power.

The cœnenchyma of the stem and walls of the polyps are densely coated with an external layer of minute spicules, which, viewed

as opaque objects under the microscope, present an irregular lenticular appearance; when seen by transmitted light they reveal a very narrow smooth central constriction, an upper round disk, minutely granulose and somewhat opaque, a lower irregular tuberculate disc, quite translucent and frequently larger than the upper.

The granular disks of these modified double clubs are directed outwards and form a fairly uniform crust over the whole colony.

Situated immediately beneath this external layer are numerous larger spicules, having a broad multilobate disk, and a very short central boss surmounted by two or more tubercles. These spicules exhibit a distinct central line of union, and the boss-like end is directed outwards.

The polyps are provided with a collar of curved spicules; on the lower dorsal surface of each tentacle are three curved spicules, a short one placed transversely with the convex side directed towards the summit, and two placed longitudinally with their convex sides inwards.

Embedded in the apices of the tentacles are a few short curved spicules, with strong dentate processes on the convex side.

(1.) The cortical spicules are rarely longer than broad. Size—.03 by .03, .04 by .35 mm.

(2.) Deep seated, broad, star-shaped, the rays and disk being studded with warty tubercles. Size—Diameter of disks from .05 to .2 mm., those measuring about .15 mm. being the most common. The height is from .03 to .1 mm.

(3.) The collar spicules are curved, sharp or blunt pointed spindles with a few distant spines. Size—.3 by .02, .35 by .03 mm.

(4.) The tentacle spicules are slightly spinose, mostly on the convex side, and frequently dentate at the apex. Size—.1 by .02, .15 by .03 mm.

Colour in formol is pale yellowish-white.

This species differs from *B. philippii* in the smaller sizes of its polyps, and from *B. mollis* in its spicular characters.

MURICELLA PURPUREA, sp. nov.

(Plate xvii., figs. 26–29.)

The colony is erect, branched in one plane; it is 120 mm. in height and 90 mm. in breadth.

The main stem is straight in its lower two-thirds, the upper third being a little curved; it arises from an enlarged base and gives off a series of short simple branches and about seven or eight larger branches, which bear numerous branchlets, these in turn bearing short, slightly flattened twigs. The larger and

smaller branches are given off almost at right angles, at a short distance from their origin they are bent or curved upwards; they are alternate, rarely opposite, and occur at intervals of from 3 to 10 mm. throughout the whole colony.

The polyps are confined to one surface, they are alternate or opposite, and arise at right angles from the front and sides of the stem and branches. A median line devoid of polyps exists on most of the younger shoots, but on the older parts it is more or less interrupted by isolated polyps; the terminal twigs invariably have an opposed pair of polyps at their apices.

The length of the main stem is 100 mm., its diameter at the base is 2.5 mm., and at the broken summit 1.5 mm.; the largest branch is 8.5 mm. in length, and 1.5 mm. in diameter; the shorter branches and twigs range from 5 to 14 mm. in length, and have a diameter of 1 mm.

The axis is of a dark brownish-yellow at the base, the branches are of lighter shade; at the base it is 1.7 mm. in diameter, the terminal twigs are .2 mm. at their origin.

The coenenchyma is thin, on the bases of the stem and larger branches, elsewhere it is a little thicker, the spicules consist of large closely tuberculated spindles, some are cylindrical to within a short distance of their acute points, others taper from the middle to sharp points, whilst some few are branched and have two or three short acutely pointed rays; they are curved bent or twisted and adapted to embrace the stem, a dried fragment presenting a wicker-work-like aspect due to the interlacing of the large spicules, the general arrangement being longitudinal.

The polyps are conical and arise from between the large spicules, they are .8 mm. in height, .8 to 1 mm. in diameter at the base and from .4 to .7 mm. at the apex.

The basal portion of each polyp is partly surrounded by the bent ends of the stem spicules and a series of other much shorter spicules, extending to the summit of the verrucæ, which are arranged longitudinally in rather indistinct groups, either erect or placed at an angle with their apices in contact. Above these is situated a narrow collar of short curved spicules, which forms a projecting rim around the summit, and arising within the collar are numerous short spiny spicules forming an operculum. There are also a few nearly smooth spicules embedded in the tentacles.

The coenenchyma spicules consist of large closely tuberculate cylindrical or fusiform spindles, occasionally branched. Size 1 by .15, 2 by .2, 3 by .27, 4.5 by .24, 5 by .28, 5.5 by .3 mm.

The polyp spicules are as follows :—

(1.) Larger straight or curved fusiform spindles with rather distant rounded tubercles. Size—.4 by .1; .6 by .15 mm.

(2.) Smaller deep seated spicules with acute points and a few scattered spines. Size—.3 by .05; .4 by .05 mm.

(3.) Curved collar spicules with a few low rounded tubercles and rather blunt ends. Size—.3 by .03 mm.

(4.) Operculate spicules with the free end acute and spiny, the lower end blunt. Size—.15 by .02 mm.

(5.) Tentacle spicules slightly curved with a few distant low spines. Size—.1 by .01.

The colour of the spicules by transmitted light varies from light to dark red. The stem when dried, appears as if coated with small silvery granules, this effect is produced by the tubercles which are—in common with the rest of the spicular surface—invested by a hyaline sheath becoming silvery white when dry. Colour in formol is dark purplish-red.

Muricella purpurea appears to be a very distinct species characterised by its gigantic spicules.

FAMILY PLEXAURIDÆ.

PLEXAURA ANTIPATHES, *Esper*.

Gorgonia antipathes, *Esper*, Die Pflanzenthier, ii., p. 90, pl. xxiii., fig. 1, 2; *Kolliker*, *Icones. Hist.*, pt. ii., 1866, p. 138, pl. xviii., figs. 21, 22; *Klunzinger*, Die Korallth. de Rothen Meeres, 1877, p. 51, pl. iv., fig. 1.

There is one large example referred with some little doubt to this species, it appears to be common, numerous specimens being in the Museum collection from the New Hebrides, Fiji, and other coral islands. The colony is 600 mm. in height and 300 mm. in breadth, the main stem is 25 mm. in diameter near the base, at a distance of 80 mm. it divides into two main branches, each of which bears a great number of branchlets, the whole forming a much ramified tree-like colony. Primarily the branching is usually in one plane, but owing to the twisting in and out of the branches during growth, this bilateral feature is somewhat obscured in the adult colony, if however the origin of the branches is carefully noted it at once becomes evident.

The branches are lateral and alternate, but frequently absent or suppressed on one side, the buds appearing as low elevations; they are a little compressed in the plane of branching, after attaining to a length of from 5 to 8 mm. they take a sudden bend upwards and the further growth of the shoot is continued in a line more or less parallel to the parent branch.

The terminal twigs are cylindrical and of equal thickness throughout, or tapering gradually and ending in low conical points, whilst some few are club-shaped with obtusely rounded apices, they measure from 3 to 5 mm. in diameter.

The polyps are generally about 1.5 mm. apart, mostly flush with the surface, except on the younger parts of the colony, where they are often somewhat prominent; their apertures when perfect are covered by eight rays composed of groups of rod-like or sub-fusiform spicules, having a few low tubercles and sharply pointed apices. Size—.1 to .15 by .02 mm.

The coenenchyma on the main stem is from 1 to 1.5 mm. in thickness, and 2 mm. on the terminal twigs; in the dried condition it is of a light stone colour.

The axis is black and spirally grooved, the stouter branches are flattened in the plane of branching.

The cortex is covered externally by a dense layer of tuberculated clubs, and a few subspherical tuberculated granules; the head of the club is directed outwards; when viewed end on from above they present a whorl of three compound tubercles; the shaft has also one or two zones of small, smooth or spiny tubercles. Size—.08 by .04, .1 by .05 mm.

The coenenchyma spicules are chiefly straight fusiform spindles, frequently branched and cross-like. The spindles have from 4 to 8 whorls of tubercles, the two central whorls are composed of large warty tubercles, the remaining whorls gradually diminish in size as they approach the very acute ends of the spicule. Size—.15 by .05, .2 by .05, .23 by .06 mm.

There are also a few comparatively smooth fusiforms, with two or more distinct whorls of low simple tubercles. Size—.1 to .15 by .03 mm.

In the terminal twigs there exist large cylindrical or subclavate spicules, having blunt apices beset with numerous compressed spines; the rest of the surface varies greatly, being either smooth, spiny, or distantly tuberculate, the lower ends are abruptly pointed. Size—.5 by .07, .6 by .08, .7 by .1 mm.

On seeing these spicules I at first thought they did not belong to the colony, but I afterwards made about six different preparations of the spicules, by nipping off the smaller twigs and boiling in potash, taking due precautions to exclude any foreign spicules; these larger spicules were found in every instance in greater or less abundance.

FAMILY GORGONELLIDÆ.

NICELLA LAXA, sp. nov.

(Plate xvii., figs. 30–33.)

The colony is feebly branched, the branching lateral and in one plane. The short basal stem is 2 mm. in diameter, and at a height of 15 mm. divides into two branches, one of which is

broken off close to its origin, the other is 25 mm. in length and 1 mm. in diameter, diminishing to .05 near the apex, at a height 30 mm. it gives off a lateral branch, bearing two branchlets the upper 45 mm. and the lower one 5 mm. in length. On the opposite side at a height of 32 mm. from the origin of the first branch is situated a second simple branch 42 mm. in length.

The axis is laminate, calcareous, brittle and of dark brownish-yellow at the base, with white or yellowish-white branches, the basal portion of the stem is cylindrical, the branches are subquad-rangular, without grooves, but marked by numerous elongated pits.

The cœnenchyma is thin, and when viewed with a lens presents a series of minute ridges forming a network of raised lines, which are lighter in colour and consist of double club shaped spicules.

The polyps are large, alternate, arising at nearly right angles and confined to the sides of the stem and branches, the verrucæ are conical, cylindrical or rarely wider at the base than at the summit, varying according to the relative amount of the retraction of the polyps within the verrucæ.

The verrucæ are divided at their summits, into eight lobes, each lobe is .3 mm. in height and .25 at the base. The verrucæ measure from 1 to 2 mm. in height, 1 to 1.5 mm. in diameter, and are from 2 to 4 mm. apart; the terminal polyps are slightly larger than those on the stem and branches.

The tentacles have a number of narrow fusiform spicules on their dorsal surface, they are straight, and either distantly tuberculate or almost smooth. There are numerous rod-shape spicules imbedded in the tentacles, they are arranged *en chevron*, their surface is either smooth or minutely but distantly dentate.

(1.) The cortical spicules are short double clubs with smooth or warty tubercles. Size—.05 by .02, .07 by .03, .1 by .05 mm.

(2.) The cœnenchyma spicules consist of broad or narrow fusiform spindles, with rather obtusely pointed ends and a spiny or tuberculate surface, some of which possess a transverse median constriction. Size—.1 by .03, .2 by .03, .25 by .05, .25 by .06 mm. Many of the spicules, both clubs and fusiforms, are a little flattened.

Colour in formol is light mouse gray. This species differs from *N. dichotoma* by its smaller more distant polyps and by its lax method of branching.

VERRUCELLA FLABELLATA, sp. nov.

(Plate xvii., figs. 34–37.)

The only specimen in the collection is in a much broken condition, and evidently only a fragment of what formed an extensive colony.

The original colony appears to have been much branched in one plane, but the base and the greater number of branches are wanting, the latter in most cases being broken off quite short.

The specimen is 275 mm. in height, the stem is angularly bent a short distance from the base; from the bend to the broken summit it presents a slightly wavy outline, and gives off a series of alternate branches from 10 to 25 mm. apart; at 130 mm. from the base there arises a branch 145 mm. in length, from which originates a series of lateral branchlets at intervals of 15 mm., these give off numerous slender twigs forming small flabellate groups.

The stem is 4 mm. in diameter at the base, where it is nearly cylindrical, above it is somewhat flattened in the plane of branching, and exhibits two longitudinal grooves, one on each side, in the median space devoid of polyps.

The axis is creamy-white, very hard, but brittle.

The polyps are numerous, alternate, nearly at right angles to their support, and retractile within the slightly conical verrucæ; the latter are divided into eight rays at the summits, which are folded over the retracted polyps.

The verrucæ are prominent, they are from .5 to 1. mm. in height, .5 to .7 mm. in diameter, and from 1. to 3. mm. apart.

The cœnenchyma is thin, smooth, and coated with a layer of double club-shaped spicules disposed in lines more especially on the verrucæ, beneath these there are numerous flattened tuberculated spicules arranged longitudinally on the branches and also in the walls of the verrucæ.

In the tentacles are a number of short spiny spicules, but owing to their retracted condition and imperfect preservation it is impossible to state with certainty how they are disposed.

The double clubs of the cortex vary greatly in length, thickness, and tuberculation. Size—.05 by .02, .07 by .02, .1 by .03 mm.

The cœnenchyma spicules are flat, elongate, and tuberculate, with a median constriction and obtusely rounded ends, the smaller of which closely resemble the double-clubs but are distinguished by being flattened. Size—.1 by .04 and .01 mm. in thickness, .15 by .05 and .02 mm. in thickness.

The tentacle spicules are short rods and spindles with a few blunt spines. Size—.05 by .01.

Colour in formol is yellowish-white.

Verrucella flabellata is distinguished from other species of the genus by its peculiar flat round-ended spicules.

THE SPONGES OF FUNAFUTI.

By THOMAS WHITELEGGE.

Zoologist, Australian Museum.

[XIII.]

THE SPONGES OF FUNAFUTI.

By THOMAS WHITELEGGE,
Zoologist, Australian Museum.

THE collection of sponges obtained by Mr. C. Hedley, though small, is nevertheless interesting.

There are sixteen species; of these the following six are described as new—*Spinoseella glomerata*, *Gellius aculeatus*, *Clathria pellicula*, *Agelas gracilis*, *Ciocalypa incrustans*, and *Polymastia dendyi*.

Of the above *Agelas gracilis* is the most interesting, as it widens the range of the genus. With the exception of an outlier recorded from Mauritius and doubtfully from Tristan d'Acunha, this genus has hitherto only been known from the West Indies.

The remaining ten species are—

Reniera australis, Lendenfeld, *Reniera* sp.* which may prove to be a variety of *Reniera rosea*, Bowerbank, *Halichondria solida*, var. *rugosa*, Ridley and Dendy, *Echinodictyum asperum*, Ridley and Dendy, of the latter rare and curious species there are two very fine examples, *Acanthella stipitata*, Carter, *A. pulcherrima*, Ridley and Dendy, *Spirastrella papillosa*, Ridley and Dendy, *Euspongia irregularis*, var. *silicata*, Lendenfeld, *Hippospongia dura*, Lendenfeld, and *Spongelia fragilis*, var. *irregularis*, Lendenfeld.

The species in many cases are represented by single examples.

The smaller specimens had been placed in a solution of four or five p.c. formol, which proved insufficient for their proper preservation. They reached me in a soft and slimy state, too soft in fact to handle with safety, and before a hand-section could be cut they had to be hardened in alcohol. In consequence of their imperfect preservation and their transference to alcohol, the specimens had some of their characters destroyed, which rendered their exact determination unusually difficult.

Mr. Hedley has kindly supplied the following field notes:—

"To a collector accustomed to the sea beaches of temperate zones, and especially to the shores of Sydney Harbour, the absence of large or conspicuous sponges on the reefs of Funafuti is very marked. Rocky shelves and ledges which in England or

* Identical with No. 42, Voy. "Alert," p. 410.

temperate Australia would be clad by a luxuriant growth of seaweeds and sponges, are here almost entirely monopolised by a rank growth of *Sarcophytum* and its allies.

An expert in spongology would doubtless reap a rich harvest on these reefs by cracking loose, dead coral blocks and securing those minute forms which hide themselves in numerous crevices. But a superficial survey of the rocks from high water mark to a depth of twenty feet, impresses on the observer that the oft described wealth and profusion of life on a coral strand is not equally true of all classes. The larger sponges, at any rate, contribute handsomer, more highly coloured, more numerous and varied forms to a sea-scape in Port Jackson, than they do in the Ellice Islands.

About low water mark the most conspicuous sponge was, perhaps, the coal-black *Euspongia irregularis*, var. *silicata*, growing in cake-shaped masses on the rocks. In similar situations *spinosella glomerata* flourished. Among the *Sarcophyta*, from which, indeed, a casual glance hardly distinguished it, the *Hippospongia dura* encrusted the rocks. From a depth of thirteen fathoms in the lagoon the dredge came up almost choked with *Echinodictyum asperum*, with which the urchins *Laganum* and *Maretia* were associated.

Nearer the centre of the lagoon, in about twenty fathoms, were dredged the new *Clathria pellicula*, encrusting a cluster of cockscomb oyster. This was only taken on one occasion.

The *Reniera* sp. was extremely plentiful in pools in the mangrove swamp, where alone it was met with. It flourished alike in shade and sunlight. At a distance it sometimes appeared as large rose-pink patches, many yards in extent, creeping under stones and climbing on mangrove roots. When deprived of light the beautiful rose-pink tended, under the shelter of the mangrove, to fade into gray. Each sponge mass attained a height of eight or ten inches, and a diameter of about a foot. In the open the growth was reduced to a prostrate network of tubes."

Order MONAXONIDÆ.

FAMILY HOMORRHAPHIDÆ.

RENIERA AUSTRALIS, Lendenfeld.

Reniera australis, Lendenfeld, Aust. Mus. Cat. xiii., Sponges, 1888, p. 78.

There are several examples of this species exhibiting considerable variation; one resembles a piece of pumice-stone with numerous crateriform oscula; others have a comparatively smooth surface, with dome-shaped oscula bearing processes.

On comparing the specimens with the type I find it presents exactly the same external characters.

The colour of the specimens from Funafuti varies from light to dark coffee brown, that of the type from Port Jackson is now (in spirit) burnt umber colour; in the description it is stated to be gray. The specimen is attached to a piece of wood, which may have stained it this colour.

The spicules exhibit a little variation in size, but the average is about the same as in the type, *i.e.*, 0.12 by 0.004 mm.

Low water-mark on reefs in the lagoon.

RENIERA SP.

This form appears to be identical with No. 42 *Reniera sp.* described by Ridley.*

There are numerous specimens in the collection, but owing to the fragile nature of the sponge all are more or less broken. The sponge consists of thin lamellæ, which form folds or tubes, with fairly large oscula at the summits; the tubes are from 5 to 10 mm. in diameter, and from 5 to 30 mm. in height, the walls are from 1 to 2 mm. in thickness, the oscula are 5 mm. in diameter. Texture very fragile when dry, in spirit slightly elastic, but easily broken if handled. Surface rather smooth in appearance to the unaided eye; when seen with a moderate magnifying power it is minutely reticulate with numerous round pores. Colour, when alive rose pink, in spirits pinkish gray.

Megasclera—Small curved oxea suddenly tapering to acute points, varying slightly in length and thickness, usually about 0.12 by 0.006 mm.

Possibly this form may be a variety of *Reniera rosea*, Bowerbank. According to Topsent, *Reniera cinera*, Grant, is identical with *R. rosea*, Bowerbank. Grant's species is recorded from the Philippines.

Mangrove swamp (*ante* p. 324).

HALICHONDRIA SOLIDA, var. RUGOSA, *Ridley & Dendy*.

Halichondria solida, var. *rugosa*, Ridley & Dendy, Chall. Rep. Zool., xx., p. 4.

A single example agreeing with the description in colour, surface, and texture. The spicules, however, are slightly less in size; the larger, stouter forms are about 0.85 by 0.025 mm. They vary greatly in length and thickness; they are usually slightly curved and taper rather suddenly a few diameters from the ends, which are more or less rounded.

Reefs in the lagoon among the *Sarcophyta*.

* Ridley—Voy. "Alert," 1894, p. 410.

SPINOSELLA GLOMERATA, sp. nov.

(Plate xviii., fig. 1).

Sponge, large cake-shaped, attached by a broad base. From the upper irregularly convex surface arise numerous short narrow tubes. The largest example is somewhat water worn, and measures 300 mm. in its long and 250 mm. in its short diameter, and about 70 mm. in height. The tubes vary greatly in size. The larger are 30 mm. in height, 10 mm. in external diameter, without the spinose processes, the internal diameter averages about 5 mm., the largest are about 8 mm. the smallest about 2 mm.

Colour of the dried sponge is light brownish gray.

The tubes are rarely free, being more or less united laterally throughout their length. The surface is beset with numerous prominent aculeations, they vary from 3 to 6 mm. in length, and are usually about 3 mm. apart; the summits of the tubes are fringed with from five to twelve of these processes. The dermal surface consists of a close reticulation of fine fibres, with numerous circular pores 0.2 to 0.5 mm. in diameter. The oscula are 1 to 1.5 mm. in diameter, and are fairly abundant on the inner surface of the tubes.

The main skeleton is composed of well developed horny fibre, with a polygonal or subrectangular mesh. The main fibres are from 0.8 to 1 mm., the secondaries 0.5 mm. in diameter, the former are sparsely cored with slightly curved oxeote spicules, the latter by a series of three or four, in the slender connecting fibres the spicules are uni- or biserially arranged.

Megasclera—Slightly curved oxea with rather blunt points.

Size—About 0.07 by 0.002 mm.

Reefs in the lagoon at low water, plentiful.

FAMILY HETERORRHAPHIDÆ.

GELLIUS ACULEATUS, sp. nov.

(Plate xviii., fig. 3).

Sponge incrusting (attached to a piece of coral), measuring 45 mm. by 20 mm., and from 5 to 12 mm. in thickness.

Surface very uneven possessing numerous compressed prominences, from 4 to 7 mm. in height, 0.5 to 0.8 mm. in their broad diameter, and from 1 to 3 mm. apart, proximally the processes are connected by narrow ridges, distally they taper to acute points; they are more or less compressed throughout their length, rarely rounded.

Dermal membrane, thin, smooth and somewhat opaque, pores not visible, oscula few, scattered, occurring between the aculeate processes, subcircular in shape and from 1.2 to 1.5 mm. in diameter.

Texture soft, compressible, moderately tough.

Colour in spirit dirty cream.

The skeleton consists of large strongylote spicules, which run more or less vertically from the base to the surface, either singly or in twos or threes, as they approach the surface they converge, forming whip-like bands from 0.1 to 0.2 mm. wide; at the surface they form the main support of the aculeations.

In addition to the large strongyla there are numerous small oxeote spicules irregularly distributed throughout the body of the sponge; they are scarce or absent from the dermal membrane, and from the aculeate processes. Sigmata of about one and a half turns are abundant and evenly distributed in the dermal membrane, internally they appear to be confined to definite tracts.

Megasclera—(a) Straight, elongate, round ended strongyla gradually tapering from the centre to the extremities.

Size—About 1.6 by 0.02 mm.

(b) Oxea, small, slender, straight, tapering gradually at each end to acute points.

Size—About 0.14 by 0.0035 mm.

Microsclera—Very slender sigmata of about one and a half turns; length about 0.02 mm.

Deep water in the lagoon.

This species is allied to *Gellius carduus* in outward form, the spicules are, however, very much larger than in that species.

CLATHRIA PELLICULA, sp. nov.

Sponge incrusting, from 1 to 1.5 mm. in thickness; surface minutely conulose, with numerous pores in groups of from four to six. Oscula scattered, circular, about 0.25 mm. in diameter.

Colour in spirits yellowish-gray.

Skeleton columnar, consisting of whip-like multispicular fibres, with little or no spongin; they are made up of irregularly disposed smooth styli or subtylostyli and accompanied by spined styli; there are but few spicules between the fibres. The dermal skeleton consists of rather distant radiating tufts of smooth styli.

Megasclera—(a) Smooth styli or subtylostyli of the fibres, gradually sharp pointed, the slightly enlarged basal extremities of the larger spicules often minutely spinose.

Size—About 0.23 by 0.0042 mm.

(b) Smooth slender styli or subtylostyli of the dermal tufts.

Size—Variable from 0.25 to 0.4 by 0.0035 mm.

(c) Echinating styli, straight, gradually tapering to sharp points, spines irregularly disposed, strong, and recurved, the apical fourth of the spicule almost smooth.

Size—0.1 by 0.008 mm.

Microsclera—(a) Minute slender isochelæ; length about 0·015 mm.

(b) Long slender toxa, with a short slight bend in the middle, straight limbs, and smooth acute points; length 0·35 mm.

This species forms a thin skin-like covering over an oyster shell, *Ostræa crista-galli*, Linn.

Obtained in the lagoon in eighteen fathoms of water.

AGELAS GRACILIS, sp. nov.

(Plate xviii., fig. 4).

Sponge subcylindrical, unbranched, attached to fragments of shells. There are four pieces, three of which take the form of simple filaments measuring from 2 to 3 mm. in diameter, and from 25 to 75 mm. in length. The fourth example consists of six or seven processes arising from an expanded base; at their origin and for about half their length they are somewhat irregular, a little flattened and joined together at various points, giving the basal portion a clathrous aspect. The upper half terminates in a series of subcylindrical filaments from 5 to 25 mm. in height and 2 mm. in diameter, which taper gradually to the extremities.

The texture is spongy and soft, but pretty tough. Colour in spirits grayish-yellow. The surface is uneven, hispid, beset with numerous minute conuli from 0·2 to 0·5 mm. high and 2 to 5 mm. apart. A few minute pores are visible between the conuli.

The skeleton is reticulate, the stout primary fibres forming an axial plexus from which secondary and connecting fibres are given off. The mesh is oblong or oval, rarely angular. The primary fibres measure 0·07 mm., the secondaries 0·045 mm., and the connecting fibres 0·025 mm.

The echinating spicules situated on the main fibres are numerous and generally more or less parallel with them, on the more slender fibres they are usually at right angles to their support.

Megasclera—Of one kind only, consisting of straight or but little curved, verticillately spined styli, from the truncated base they taper gradually to sharp points. The verticils vary in number from 16 to 24, according to the size of the spicule. The first three or four are closer than the rest, and consist of prominent straight spines, towards the apex the spines are recurved.

Size—Variable from 0·1 to 0·22 mm. by 0·007 to 0·013 mm. The verticils are about 0·01 mm. apart.

Obtained by tangles, associated with *Gorgonia*, in forty to seventy fathoms, on the western slope of the atoll.

ECHINODICTIUM ASPERUM, Ridley & Dendy.

Echinodictium asperum, Ridley & Dendy, Chall. Rep. Zool., xx., p. 165, pl. xxxii., fig. 2.

Of this well marked species there are two examples, one dry the other in spirit. The dried example measures 170 mm. by 120 mm., and 100 mm. in height. The one in spirit measures 120 mm. by 95 mm., and 90 mm. in height. They are thus larger than those obtained by the Challenger Expedition.

The spined styli are smaller than those of the type, they seldom exceed 0·12 in length.

Colour in spirit, gray.

Dredged in the lagoon in company with *Laganum* and *Maretia*.

FAMILY AXINELLIDÆ.

ACANTHELLA STIPITATA, *Carter*.

Acanthella stipitata, Carter, Ann. and Mag. Nat. Hist., (5), vii., p. 380, pl. xviii., fig. 8; Ridley & Dendy, Chall. Rep. Zool., xx., p. 178; Dendy, Proc. Roy. Soc. Vic., (n.s.) ix., 1896, p. 237.

A small fragment is here somewhat doubtfully referred to this species.

Deep water in the lagoon.

ACANTHELLA PULCHERRIMA, *Ridley & Dendy*.

Acanthella pulcherrima, Ridley & Dendy, Chall. Rep. Zool., xx., p. 177, pl. xxxii., fig. 3.

A single specimen of this species is in the collection.

Associated with the preceeding.

CIOCALYPTA INCRUSTANS, sp. nov.

(Plate xviii., fig. 2).

Sponge incrusting, forming large flat expansions of a fairly uniform thickness. There are several pieces, the largest is 55 mm. by 45 mm., and 10 mm. in thickness.

Colour in formol yellowish-white.

Texture soft and fragile, readily breaking by its own weight if handled.

Surface minutely conulose; the conuli are from 1 to 1·5 mm. apart, and from 0·5 to 1 mm. in height.

The dermal membrane is thin and transparent, with numerous inhalent pores which are situated in the depressions between the conuli. Oscula scattered about 2·5 mm. in diameter, with slightly raised margins.

Skeleton.—The main skeleton consists of columns of spiculo-fibre without much obvious spongin. The columns run vertically from the base to the surface where they terminate and form the support of the dermal membrane. The columns are from 0·3 to 0·6 mm. in diameter, they are separated by spaces 0·4 to 0·6 mm. wide.

The fibres are pretty uniform in diameter without any well defined branches. Occasionally they appear to be connected by a somewhat dense bundle of spicules. The intercolumnar spaces are sparsely spiculate. The spicules are rather irregularly arranged, both in the spaces and the columns. There are no traces of a special basal or dermal layer of spicules.

Megasclera—Of two kinds, stylote and oxeote. (a) The styli are usually curved, rarely straight, often bent a short distance from the well rounded base; they taper gradually from about the middle to sharp points.

Size—Variable, about 0.2 to 0.04 mm. by 0.0095 mm.

(b.) The oxea are not so numerous as the styli, they are usually bent in the middle, and taper gradually to sharp points.

Size—About 0.35 by 0.0075.

Besides the above, there are a number of very slender oxea and styli scattered through the body, probably the young of the larger forms.

Reefs in the lagoon.

FAMILY SUBERITIDÆ.

POLYMASTIA DENDYI, sp. nov.

(Plate xviii., fig. 5).

Sponge sessile, consisting of a series of mammiform processes more or less united at their bases, the upper third or half being free. The single example in the collection is 35 mm. in its long and 25 mm. in its short diameter, and about 8 to 12 mm. in height. The mammiform processes are roundly conical, varying somewhat in size; they are from 4 to 12 mm. in diameter at the base.

The sponge is pretty firm, elastic, and moderately tough, the surface has an appearance like velvet, due to the projecting stylote spicules.

The oscula are minute, and are situated in the centre of a smooth membrane at the summits of the processes. The aperture is about 0.25 mm. in diameter. The smooth membrane about 1.5 mm. The oscula margin is plain or but very slightly raised, pores not visible.

Colour in spirits light sandy gray.

Skeleton composed of numerous, slender columns of spiculo-fibre running vertically towards the surface, where they terminate in tufts of diverging spicules which project a considerable distance beyond the dermal layer, and give the surface the characteristic velvety appearance. The dense dermal layer of small spicules is about 0.3 mm. in thickness; they are somewhat irregularly dis-

posed, not strictly vertical to the surface as is usually the case in other species.

Megasclera—(a) Of the main body, large straight styli, a little tapering to a rounded base, and gradually tapering to a not very acute apex, many of the larger spicules which project through the dermis, are suddenly contracted at about one or two diameters from the distal extremity.

Size—About 1·5 by 0·012 mm.

(b) The small slender styli of the dermal layer have a rounded base and a tapering acute apex, a few similar spicules are found scattered throughout the body of the sponge, especially in the walls of the canals.

Size—About 0·19 by 0·0025 mm.

Reefs in the lagoon associated with *Sarcophyta*.

FAMILY SPIRASTRELLIDÆ.

SPIRASTRELLA PAPILLOSA, *Ridley & Dendy*.

Spirastrella papillosa, *Ridley & Dendy*, *Chall. Rep. Zool.*, xx., p. 232, pl. xli., fig. 5; pl. xlv. figs. 11–11g.

A much broken specimen is here somewhat doubtfully referred to this species.

The example is reduced to a pulp, and it is impossible to say what its external characters were; during growth it appears to have enveloped large quantities of broken shells, calcareous seaweeds, and bits of coral.

The size and character of the spicules agree closely with the description given in the *Challenger Report*.

Colour in formol orange.

Occurring in the crevices of dead coral, shallow water on the lagoon reefs.

Order MONOCERATINA.

FAMILY SPONGIDÆ.

EUSPONGIA IRREGULARIS, var. *SILICATA*, *Lendenfeld*.

Euspongia irregularis, var. *silicata*, *Lendenfeld*, *Mon. Horny Sponges*, 1889, p. 255, pl. xiii., fig. 2; pl. xxi., fig. 10.

Two examples of this species are in the collection, one in spirit the other dry. The colour of the spirit specimen is dark blackish brown externally, internally of a light salmon.

The main fibres of the skeleton are charged with foreign spicules, from the secondary and connecting fibres they appear to be absent.

On the reefs in the lagoon (*ante* p. 324).

HIPPOSONGIA DURA, Lendenfeld.

Hippospongia dura, Lendenfeld, Mon. Horny Sponges, 1889, p. 298, pl. 17, fig 15.

There are five pieces, all of which appear to have been cut from one large specimen. The sponge evidently formed a cake-shaped mass; it consists of stout lamellæ joined at various points, both vertically and at the surface, with a number of subcylindrical or long, narrow meandering lacunæ between.

The dermal membrane is continued over the whole surface of the sponge. Groups of from 20 to 30 oscula pores occur in the membrane overlying the lacunæ, the pores vary in shape from round to oval, and are from 1 to 3 mm. in diameter.

Isolated reticulate patches, with small inhalent pores, exist on the elevated parts of the surface chiefly between the conuli; the rest of the surface is smooth and imperforate. The general surface is uneven and conulose; the conuli are variable in height and in their relative distance apart. They are all more or less connected by low intervening ridges, and usually about 3 mm. high, and about the same distance from each other, especially on the marginal and elevated regions; elsewhere they are low and widely separated.

The skeleton consists of a dense network of uniform fibres, entirely free from foreign bodies; they are scarcely separable into main and secondaries, and measure from 0.015 to 0.02 mm. in diameter.

In the denser parts of the sponge the fibres are arranged in trellis-like clusters, the mesh is elongate, angular, rarely with rounded corners; the fibres at their points of union are not perceptibly dilated, but retain their cylindrical form.

In the lagoon with *Sarcophyta*.

This species has hitherto only been recorded from the American coast of the North Atlantic.

FAMILY SPONGELIDÆ.

SPONGELIA FRAGILIS, var. IRREGULARIS, Lendenfeld.

Spongelia fragilis, var. *irregularis*, Lendenfeld, Mon. Horny Sponges, 1889, p. 662, pl. xxxvii., fig. 10.

This species is represented by several examples in a much broken condition.

Colour in spirit, yellowish-gray.

Occupying crevices in dead and honeycombed blocks of coral, on the lagoon reefs.

I owe the accompanying illustrations to my colleague, Mr. Edgar R. Waite, from whose careful drawings they have been reproduced.

THE ENTEROPNEUSTA OF FUNAFUTI.

PART II.

BY JAS. P. HILL,

Demonstrator of Biology in the University of Sydney.

[XIV.]

THE ENTEROPNEUSTA.

PART II.

BY JAS. P. HILL,

Demonstrator of Biology in the University of Sydney.

[Plates XIX.-XXII.]

INTERNAL ANATOMY OF *Ptychodera hedleyi*.

Proboscis.—In the larger specimens examined the epidermis of the proboscis has a thickness of about .13 mm. Below the two-layered limiting membrane is the thin circular muscular layer, with a thickness of .017 mm., *i.e.*, slightly thicker than the same layer in *P. minuta*.*

Anterior to the central proboscis organs the longitudinal musculature almost entirely fills up the cavity of the proboscis; only a small circular space filled up by spongy connective tissue is left towards the centre of the latter. Below this space the centrally situated longitudinal fibres form an interlacing bundle which posteriorly, shortly in front of the central organs, divides into two portions. These pass back laterally to the central organs to take their origin with the more peripherally situated fibres from the posterior wall of the proboscis. The longitudinal musculature is not divided into radial masses.

In this species the fibres of the dorso-ventral muscle-plate are very strongly developed, with which fact is to be correlated the flattened tongue-like form of the proboscis in preserved specimens. In respect to the degree of development of the dorso-ventral muscle-plate, *P. hedleyi* may be best compared with *Balanoglossus kupfferi*.†

In my preparations of this species it can be clearly seen that numbers of the fibres of this dorso-ventral plate are inserted directly into the limiting membrane of the anterior end of the "notochord," which here is not covered by the glomerulus (fig. 6, *dsc.*). Arising in the dorso-median line the fibres of this system

* J. W. Spengel—Die Entropneusten des Golfes von Neapel, etc. Fauna u. Flora des Golfes von Neapel, 1893, p. 17, etc. See *ante* p. 207.

† Spengel—*loc. cit.*, pl. xiv., fig. 2.

extend on to the lateral walls of the heart-bladder, and also in front of the heart-bladder form a vertical sheet, the fibres of which converge to be inserted directly into the limiting membrane of the apex of the "notochord" (Plate xix., fig. 6, *dsc.*). From here also fibres arise which diverge downwards and forwards on each side of the ventral septum. The ventral septum, accompanied by fibres of the muscle plate, passes obliquely downwards and forwards from the anterior end of the "notochord," its most anterior ventral point of affix being a considerable distance in front of the apex of the "notochord." Behind the apex of the "notochord," the ventral fibres of the plate are inserted into the limiting membrane on its ventral surface, on each side of the attachment of the ventral septum (fig. 1, *vps.* and *dsc.*). The splanchnic epithelium of the proboscis coelom (fig. 1, *sp.*) has the usual relations. As in *P. minuta* and *P. australiensis*, the splanchnic epithelium is covered by a layer of spongy tissue representing the inner limiting layer of the connective tissue of the proboscis.

As in other species, a free space representing the proboscis coelom is present round the central organs. The ventral septum (fig. 1, *vps.*) has oblique anterior and posterior free edges (fig. 2, *vps.*). Behind its posterior free edge there is an unpaired ventral pocket (fig. 3, *vp.*) which ends blindly in what appears to be simply the thickened basement membrane of the epidermis below the anterior portion of the proboscis skeleton (fig. 4, *vp.*).

The dorsal proboscis pockets (figs. 2 and 3, *dp.*) separated by the heart-bladder, pass backwards, and, on a level with the posterior end of the unpaired ventral pocket, each becomes constricted to form a small and short ventral canal (fig. 4, *dp'.*) which ends blindly, and a much larger dorsal canal, the proboscis canal (*pc.*) The two proboscis canals may either open into each other, thus forming a single canal which opens to the exterior by a single median proboscis pore, or the canals may remain separate and open independently to the exterior, thus forming two proboscis pores, one on each side of the median line (fig. 5, *p.*).

"*Notochord.*"—The "notochord" has the usual Ptychoderan shape. Anteriorly it appears, in section, of an oval outline, with a large central lumen. In the region of the ventral blind sac, it is markedly extended transversely and somewhat dorso-ventrally compressed (fig. 2). From the lumen of the blind sac there pass forwards two short lateral horns (fig. 2, *lb.*) as in *P. australiensis*. In the posterior portion of the proboscis neck, the "notochord" is also dorso-ventrally flattened. Its dorsal wall is here much thicker than the ventral, and provided with numerous glands. The ventral wall shortly in front of the opening of the "notochordal" lumen into the throat becomes reduced to a low layer of columnar or cubical cells resting on the proboscis skeleton.

As in other species, the "notochord" possesses a continuous wide lumen, crossed here and there by cellular bridges, and reaching to near its apex. Numerous glands open into the lumen along its whole extent, but are specially abundant in the dorsal wall of the neck of the "notochord."

Proboscis Skeleton.—The "end plate" (fig. 3, *eps.*) closely invests ventro-laterally the posterior portion of the blind sac, which here is somewhat quadrangular in outline (fig. 3, *lbs.*) Behind, the end plate narrows and passes over into the body of the proboscis skeleton, overlying the posterior portion of the unpaired ventral proboscis pocket. The body is at first convex below and provided with short nearly vertical wings investing the "notochord" laterally. Posteriorly the ventral surface of the body soon loses its convex form, and behind the posterior end of the ventral proboscis pocket is distinctly keeled. In sections just behind the ventral proboscis pocket the entire skeleton is found to consist of a dorsal flattened portion prolonged on each side into short almost horizontal wings, below which is a blunt triangular keel-like projection. In the dorsal portion, the lines of stratification correspond with the ventral wall of the "notochord"; it thus represents the "body" of the skeleton. In the ventral projection the lines correspond in direction with the adjacent epidermis: it thus represents the "keel" of the skeleton.

In this species the "keel" is not separated from the "body" by "chondroid tissue," and it is not provided with distinct lateral outgrowths or wings. Posteriorly the keel gradually becomes blunter and thicker and at the same time decreases in height, until, at the level of the proboscis pores, the entire skeleton has the shape shown in fig. 5. The skeleton (*vps.*) is here in section again convex below, slightly concave above and provided with two short ventrally curved wings. The skeleton continues in this condition up to the point of union of the proboscis neck with the inner face of the collar. Here the "nuclei" of the "legs" appear, separating the now thin "body" from the ventral part of the skeleton, the continuation of the "keel." Posteriorly the "nuclei" eventually separate from each other to form the diverging "legs" of the skeleton, which end considerably in front of the mid-region of the collar.

The "chondroid tissue" of the proboscis neck (figs. 2-4, *ch.*) is, as in other species of the genus, not very strongly developed. The cell strands penetrating it are derived mainly from the ventral proboscis pocket, and also in lesser degree from the dorsal pockets.

Heart-bladder.—The heart-bladder has the usual relations. Anteriorly (fig. 1, *h.*) it is prolonged down on each side of the "notochord" so as to enclose about the upper three-fourths of the latter. It does not extend quite to the extreme apex of the "notochord."

Posteriorly the cavity of the heart-bladder is occupied by cellular tissue crossed dorsally by transverse fibres passing between its lateral walls. As in other species its ventral wall (fig. 1, *vw.*) is provided with a layer of transverse muscular fibres.

Proboscis Vessels.—The glomerulus is shown in transverse section in fig. 1 (*gl.*). It does not cover the anterior end of the "notochord" as in *P. minuta* and *P. australiensis*, its two halves being separated by the fibres of the dorso-ventral muscle plate inserted into the apex of the "notochord." The central blood space (figs. 1 and 6, *chs.*) opens freely on each side into the glomerulus sinus on the lower portion of the lateral walls of the heart-bladder. The efferent proboscis vessels (figs. 2–5, *epv.*) only become distinct at the posterior end of the glomerulus. They are not joined by a connecting vessel in the proboscis neck as in *P. australiensis*.

The afferent (figs. 2–4, *av.*) and efferent vessels of the subepidermic network have the usual relations.

Along the mid-ventral line of the proboscis there runs a small vessel internal to the circular musculature, which stands at intervals in connection with the subepidermic capillary net, the circular muscular layer being interrupted at these points. When the ventral septum appears this vessel apparently passes up along its anterior edge.

Collar.—The five zones of the epidermis (*cf.* Part I.*) are distinct in longitudinal section. The first zone, including slightly more than the anterior free rim of the collar, and the fifth zone, forming the posterior rim of the collar, stain similarly and not very deeply. The second and fourth zones stain deeply, while the third zone stains less deeply. The collar musculature has the usual relations.

The perihæmal spaces, as in *P. sarniensis*, *aperta*, and *australiensis*, enclose about the ventral half of the collar nerve cord (Plate xx., fig. 7, *phs.*).

As may occur in *P. australiensis*, the dorsal septum of the collar appears as a free fold in front of the first root and reaches the epidermis along with the latter. From here it extends to the posterior end of the collar. The ventral vessel consists of a single fold. It unites either near the mid-region of the collar or nearer its posterior end, with a median subepidermic vessel to form the ventral septum of the collar. The dorsal vessel in the collar occupies the whole of the mesentery between the perihæmal spaces.

The collar canals (fig. 8, *ccl.*) have the usual shape and are relatively short. Each runs obliquely backwards and downwards to become continuous with the anterior wall of the first gill-pocket.

* *Ante*, p. 207.

The outer opening of the canal is expanded and provided with thick out-turned lips. In this species the first and second gill pockets have a common efferent portion into which the collar canal opens (fig. 8, *g.c.* 1 and 2).

Nerve Cord of Collar.—The collar nerve cord is dorso-ventrally flattened and band-like in shape, convex above and concave in its mid-region below (fig. 7, *cnc.*). As in *P. sarniensis*,* a continuous axial canal (fig. 7, *cnl.*) opening both anteriorly and posteriorly is present in the cellular part of the cord. The axial canal is wide and dorso-ventrally compressed like the cord itself. Towards its anterior end, it narrows to open to the exterior by the small anterior neuropore (fig. 6, *an.*), the posterior neuropore is a slightly larger opening. The canal is lined by a cuticular layer, and there open into it numerous gland cells, especially abundant and large in the ventral wall of the canal. The ventral wall is very much thicker than the dorsal. As in other species of the genus, the cellular part of the cord is completely invested by the fibrous layer, but here the layer of fibres on the dorsal surface of the cord is a very thin one.

Dorsal Roots.—As in *P. australiensis*, the first root may arise from the collar nerve cord quite near its anterior end. The roots are quite irregular, both in size, number, course, and disposition. They vary in number from one to two roots, situated in the anterior half of the cord, to four, seven or eight, in four specimens examined. The axial canal of the cord is not prolonged into any of the roots. They all possess a solid cellular core surrounded by a thin fibrous layer, and are invested by the usual basement membrane carrying blood. Where they join the epidermis, they cause no interruption of the cells of the latter such as occurs in *P. minuta* and in, at least, the most anterior of the roots in *P. australiensis*.

Trunk.—Except for a thin layer of circular muscles below the epidermis at the extreme posterior end of the body, forming the anal sphincter, a circular muscular layer is absent below the epidermis of the trunk, as occurs in no other described species of the genus *Ptychodera*.

Branchial Region.—Owing to the absence of both genital pleura and cushions in this region, it has in transverse section a dorso-ventrally compressed ovalish outline (Plate xix., fig. 2). The dorsal nerve (Plate xxi., fig. 9, *dn.*) lies at the bottom of a deep median groove, wider below and narrow above. The epidermis forming the lateral walls of the wider ventral part of this groove contains numerous gland cells and stains very deeply (fig. 9). Gland cells are also present in small numbers

* Spengel—*loc. cit.*

in the cellular part of the dorsal nerve, while they are almost entirely absent in the cellular part of the ventral nerve. The course of the ventral nerve (fig. 9, *vn.*) is marked by a very shallow median groove.

Laterally to the dorsal median groove, there is on each side a shallower branchial groove, the epidermis forming the lateral walls of which also contains numerous gland cells and stains deeply (fig. 9, *brg.*).

The longitudinal musculature (fig. 9, *lmt.*) follows immediately on the basement membrane of the epidermis. It is interrupted dorsally and ventrally by the dorsal and ventral vessels, and also along the sub-median lines situated close to the base of the lateral wall of the branchial grooves (fig. 9). Numbers of radial fibres pass inwards from the limiting membrane of the epidermis to be inserted into the walls of the œsophagus and gill pockets. The cœlom is here completely subdivided into two, above by the dorsal mesentery and below by the ventral vessel. In mature specimens the lateral halves of the cœlom are almost completely occupied by the gonads.

The alimentary canal is, as in other species of the genus, divided into a dorsal branchial canal (fig. 9, *gg.*) and a ventral œsophageal canal (*œ.*). The line of separation between the two is marked by two projecting longitudinal ridges, the limiting ridges (fig. 9, *lc.*), but in this species these two ridges are widely separated from each other so that the branchial and œsophageal canals are in open communication (fig. 9).

The epibranchial band (fig. 9, *epb.*) along the mid-dorsal line of the branchial canal is composed of long narrow cells, and stains only slightly. It contains small gland cells in no great abundance and with no definite arrangement.

The gill pockets have the same general structure as in *P. minuta*. The synapticulæ of the gill skeleton (fig. 9, *sn.*) do not exceed thirteen or fourteen in number, those more dorsally situated being usually wider apart than the more ventral ones. The gill pores open into the branchial grooves just mesial to the sub-median lines as in *P. minuta*, and, as in that form, oblique slips of the longitudinal musculature pass between successive pores.

In the non-ciliated epithelium of the outer, the anterior and posterior walls of the efferent portions of the gill pockets, as well as in that of the outer walls of the gill tongues ("tongue bottom") there occur numbers of gland cells (figs. 9 and 10). The outer wall of the gill tongue ("tongue bottom") is not enfolded into the cavity of the tongue (fig. 10) as is found to be the case in sections through the gills of *P. minuta* and *P. australiensis*.

The inner concave wall of the gill tongue ("tongue back") is composed of the usual high epithelium, in the anterior and posterior faces of which small flask-shaped gland cells occur (fig. 10, *gtb.*).

The first gill pocket lies under cover of the posterior end of the collar, and as has already been mentioned, the first and second pockets have a common efferent portion which opens to the exterior between the collar and trunk by a narrow slit-like canal (Plate xx., fig. 8, *gp. 1* and *2*).

The gills in one of the larger specimens of this species with a gill area measuring 3 cm. in length, would number considerably over one hundred pairs.

The usual septa and gill tongue vessels are present (Plate xxi., fig. 10). The dorsal vessel in this region occupies only the dorsal half of the dorsal mesentery, and the afferent gill vessels diverge about opposite the gill tongues outwards and downwards from its ventral side as in *P. minuta*. As Spengel describes, each afferent vessel stands in direct connection with the two vessels in the gill tongue lying one on each side just within the tongue bars of the gill skeleton, and also in connection with a septal vessel, apparently in this species with either the septal vessel of the septum in front of, or behind the corresponding tongue. The capillary system of the gill tongues also appears to stand in connection with the septal vessels by connecting branches running round the dorsal ends of the gills.

In this species these leave the ventral side of the dorsal vessel, not only the afferent branchial vessels, but also branches which pass to the mesial wall of the efferent portions of the gill pockets (fig. 9).

Towards the posterior end of the branchial region the median dorsal groove becomes much shallower, while the branchial grooves become markedly wider and deeper. The median dorsal portion of the body in the region of the developing gill pockets thus forms a prominent longitudinal projection in which the branchial canal is situated, while the dorso-lateral portions of the body stand out as thick free wings. The gill pores here open near the middle of the mesial wall of the widened branchial groove, while the genital pores open on its lateral wall, about on a level with the gill pores.

Genital Region.—In the anterior portion of this region, just behind the last developing gill pockets, the alimentary canal of *P. hedleyi* exhibits a noteworthy differentiation into two portions similar to and perhaps even more marked than that described by Spengel for the corresponding portion of the intestine in *P. erythraea* and *P. bahamensis*.

Plate xxii, fig. 11, represents a section taken shortly behind the last pair of gill pockets, and it will be seen that we have here the same general external form of the body as was described above for the posterior portion of the branchial region. In other words, the median dorsal projection there found continues back into the anterior portion of the genital region, and is bounded laterally by deep grooves, the continuations of the branchial grooves, now, however, much deeper and narrower below. Beneath these grooves, the longitudinal musculature is absent.

Just as the median dorsal projection in the posterior branchial region lodged the branchial canal, so here it lodges a remarkable thick-walled dorsal division of the alimentary canal (fig. 11, *idv.*) which is joined by a short, laterally compressed stalk, to a ventral division of the intestine, lined by ordinary intestinal epithelial cells (fig. 11, *i.*). The dorsal division possesses a small lumen which opens by a narrow slit-like cleft in the connecting stalk, into the broad and dorso-ventrally compressed lumen of the ventral division.

At its anterior end the dorsal diverticulum projects forwards over the last pair of gill pockets as a very short, free, blindly-ending tube, the lumen of the diverticulum opening below into that of the branchial canal. The lumen of the ventral division of the intestine is the direct continuation of the œsophageal canal of the branchial region.

Posteriorly the slit-like canal of communication between the dorsal and ventral divisions of the intestine gradually widens out, and at the same time the dorso-lateral corners of the ventral division of the gut extend inwards mesially, giving rise to two prominent folds, one on each side of the opening between the two divisions. These two folds eventually become free and end shortly behind the point of complete merging of the dorsal division into the ordinary gut. It has also to be mentioned that posteriorly the branchial grooves by the fusion of the mid-portions of their opposite walls, form two very short and blindly-ending canals which pass back one on each side in the trunk cœlom, alongside the dorsal diverticulum.

This dorsal division of the gut is lined by a very deeply staining and slightly folded epithelium measuring up to .25 mm. in thickness. The epithelium is composed of long, narrow cells closely packed together, with small rod- or spindle-shaped nuclei. The cell-protoplasm contains large numbers of small granules staining a dull red with eosin. Below the thin cuticular covering of the epithelium there occur very numerous gland cells, which open freely into the lumen of the diverticulum.

As has already been mentioned, Spengel has described the occurrence of a similar subdivision of the gut canal just behind

the branchial region, in the two members of the sub-genus *Chlamydothorax* (*P. erythræa* and *P. bahamensis*) examined by him. Of *P. erythræa* he says :—" Der Darm (of the part of the genital region immediately following on the branchial region) durch zwei seitlich einspringende Falten in zwei Halbcanaë, einen dorsalen und einen ventralen, geschieden erscheint. Ersterer stellt eine tiefe Rinne dar, die von einem mächtigen, drüsenreichen Epithel ausgekleidet ist ; letzterer dagegen ist breit und niedrig, seine Wand verhältnissmässig dünn. Der Querschnitt des Darms ist entsprechend etwa ankerförmig."*

In *P. hedleyi* this dorsal diverticulum of the gut appears to be more markedly separated from the ventral division than in *P. erythræa* (cf. fig. 11 with Spengel's fig. O, page 182). In both cases the dorsal division is lined by a very thick epithelium with numerous glands.

In *P. bahamensis*, according to Spengel, the same features are found, but not in such noteworthy proportions as in *P. erythræa*.

In *P. flava* which, as Willey† has shown, also belongs to the sub-genus *Chlamydothorax*, I find in the portion of the gut in question a similar subdivision into dorsal and ventral portions. The dorsal division is small and lined by a moderately thick epithelium, in which, however, glands are not specially developed. This dorsal division is connected with the large thin-walled ventral division by a laterally compressed stalk, with a very narrow lumen. Gland cells are especially abundant in the thick epithelium of the stalk. Altogether in *P. flava* this dorsal division of the gut is a much smaller and much less prominent structure than in *P. hedleyi*.

Neither in *P. hedleyi* nor in *P. flava* is there any differentiation of muscular layers in connection with this part of the gut, such as Spengel describes for *P. erythræa* and *P. bahamensis*. In *P. hedleyi* the above described dorsal diverticulum of the intestine is such a well defined structure that we cannot but regard it as possessing some definite function. Without doubt it is a mucus-secreting organ, but the presence of granules in the protoplasm of its epithelial cells suggests also that it has some other function, probably digestive. In this connection it may be mentioned that in one out of three specimens sectionised, the lumen of the diverticulum contained what appeared to be partially disorganised animal remains.

* Spengel—*Loc. cit.*, p. 182.

† A. Willey—On *Ptychodera flava*, Esch. *Qt. Journ. Micro. Sci.*, xl, 1, 1897, p. 165.

Behind the intestinal diverticulum of the anterior portion of the genital region, the genital cushions gradually become more prominent until about the middle of the genital region proper they form marked thick lateral projections (fig. 12, *gnc.*) into which the dorso-lateral portions of the gut pass. Posteriorly the genital cushions gradually fade away as the hepatic region is approached.

The coelom in the genital region is completely divided into two lateral halves, above by the high dorsal mesentery, and below by the ventral vessel. The dorsal vessel (fig. 12, *dv.*) occupies only a small portion of the dorsal half of the dorsal mesentery. The lateral septa have the usual relations: they extend into the posterior portion of the branchial region.

Gonads.—In the branchial region, gonads exist only laterally to the gill pores. They are much branched sacs, occupying in mature individuals the greater part of the coelom in that region. In *P. minuta* and *P. sariniensis*, according to Spengel, the gonads in the branchial region are simple unbranched sacs. The genital pores open in the submedian lines close to the base of the lateral wall of each branchial groove. Towards the hinder end of the branchial region, the submedian lines shift upwards, so that the genital pores on each side open into the branchial groove about the middle of its lateral wall. Posteriorly the submedian lines pass still more dorsally, and, in the genital region proper, the genital pores open close to the free margin of the genital cushions on their mesial sides (fig. 12, *gap.*).

In the genital region the gonads consist each of two main subdivisions (1) a lateral division situated on the outer side of the lateral septum (fig. 12, *glt.*) and (2) a mesial division situated on the inner side of the septum and extending mesially towards the dorsal mesentery (fig. 12, *gm.*). Both these main subdivisions are again irregularly branched.

Post-genital Region.—The hepatic region in its general features corresponds with that of *P. minuta*. The intestinal and hepatic epithelial cells contain numbers of greenish granules.

The hind body calls for no detailed consideration. The two ciliated grooves of the intestine are related essentially as in *P. australiensis*. The intestine is provided with a long and high keel-like process, the slightly enlarged ventral edge of which overlies the minute ventral vessel. The dorsal and ventral vessels, the keel-like process of the intestine, and the dorsal nerve disappear shortly in front of the posterior end of the body. The ventral nerve can be traced to the extreme posterior end. The radial fibres passing between the limiting membrane of the epidermis and that of the intestine are well developed.

Round the terminal portion of the body there is below the limiting membrane of the epidermis a thin layer of circular muscles which, with the delicate circular muscles round the terminal part of the intestine, form a sphincter round the anus.

SUMMARY.

(1) The Pacific species, *P. hedleyi*, is to be associated with the two European species *P. minuta* and *P. sarniensis* in the subgenus *Ptychodera* (*sensu stricto*), especially characterised by the rudimentary character of the genital pleura.

(2) In the possession of a continuous axial canal in the dorsal nerve cord, opening both anteriorly and posteriorly, *P. hedleyi* agrees with *P. sarniensis*, while in the possession of two longitudinal epidermal stripes overlying the two ciliated grooves of the intestine, it agrees with *P. australiensis*.

(3) *P. hedleyi* exhibits affinities with the members of the subgenus *Chlamydothorax* (*P. erythraea*, *P. bahamensis*, and *P. flava*) in the possession of a dorsal thick-walled glandular division of the intestine just behind the branchial region. It is suggested that this dorsal diverticulum may, in *P. hedleyi*, have some digestive function.

(4) As regards the degree of development of the dorso-ventral muscle plate, *P. hedleyi* may be best compared with *Balanoglossus kupfferi*.

(5) *P. hedleyi* differs from all hitherto described species of the genus *Ptychodera*, and agrees with the members of the genus *Balanoglossus* in the absence of a circular musculature in the trunk.

REFERENCE LETTERS.

- an.* Anterior neuropore.
- av.* Afferent vessels of subepidermic capillaries of proboscis.
- bps.* Body of proboscis skeleton.
- brg.* Branchial groove.
- cbs.* Central blood-space of proboscis.
- coll.* Collar canal.
- ccp.* Prolongations of collar coelom into the proboscis neck.
- cfw.* Circular musculature of outer wall of anterior rim of collar.
- ch.* "Chondroid tissue."
- cl.* Cleft into which dorsal vessel opens.
- cm.* Circular musculature of proboscis.
- cnc.* Collar nerve cord.
- cnl.* Axial canal of collar nerve cord.
- cæ.* Collar coelom.
- cæ'.* Part of collar coelom into which the collar canal opens.
- div.* "Notochord."

- dn.* Dorsal nerve of trunk.
- dp.* Dorsal proboscis pockets.
- dp.* Blindly ending ventral portions of dorsal proboscis pockets.
- dsc.* Fibres of dorso-ventral muscle plate.
- ds.* Dorsal septum of collar.
- dv.* Dorsal vessel.
- ep.* Epidermis.
- epb.* Epibranchial strand.
- eps.* "End plate" of proboscis skeleton.
- epth.* Epithelium of throat.
- epv.* Efferent proboscis vessels.
- g.* Gonads.
- gap.* Genital aperture.
- gc.* Gill pocket.
- gg.* Branchial canal.
- gl.* Glomerulus.
- glt.* Lateral gonad branch.
- gm.* Mesial gonad branch.
- gnc.* Genital cushion.
- gp.* Gill pore.
- gs.* Gill septum.
- gt.* Gill tongue.
- gtb.* Epithelium of "gill tongue back."
- gtc.* Cavity of gill tongue.
- h.* Heart-bladder.
- i.* Intestine.
- idv.* Intestinal diverticulum, just behind branchial region.
- ifw.* Musculature of fore wall of anterior rim of collar.
- ies.* Low cubical epithelium covering the inner edge of the septal bar and the surfaces of the tongue bars.
- lb.* Anterior horn of lumen of the "notochordal" blind sac.
- lbs.* Ventral blind sac of "notochord."
- lc.* Limiting cushions between branchial canal and oesophagus.
- lfw.* Longitudinal musculature of outer wall of anterior rim of collar.
- lm.* Longitudinal musculature of proboscis.
- lmt.* Longitudinal musculature of trunk.
- ls.* Lateral septa of trunk.
- nf.* Nerve fibre layer.
- ngr.* Nerve fibre ring of proboscis neck.
- ntr.* Nerve ring at posterior end of collar.
- œ.* Oesophagus.
- ol.* Opening of lumen of "notochord" into the throat.
- p.* Proboscis pore.
- pc.* Proboscis canal.
- phs.* Perihæmal spaces.
- pps.* Peripharyngeal space.
- ps.* Proboscis skeleton.
- rf.* Radial fibres between fore and outer walls of anterior rim of collar.
- sn.* Synapticulæ.
- sp.* Splanchnic epithelium of proboscis cœlom.
- spr.* Septal bar of gill skeleton.
- tpr.* Tongue bars of gill skeleton.
- vgs.* Septal vessel.
- vn.* Ventral nerve.
- vp.* Ventral proboscis pockets.
- vps.* Ventral septum of proboscis.
- vv.* Ventral vessel.
- vw.* Ventral wall of heart-bladder.

EXPLANATION OF PLATE XVI.

Keroeides gracilis, sp. nov.

- Fig. 1. Colony. Nat. size.
„ 2. Cortical spicule.
„ 3. Polyp spicule.
„ 4. Operculate spicule.
„ 5. Portion of the axis.

Acanthogorgia breviflora, sp. nov.

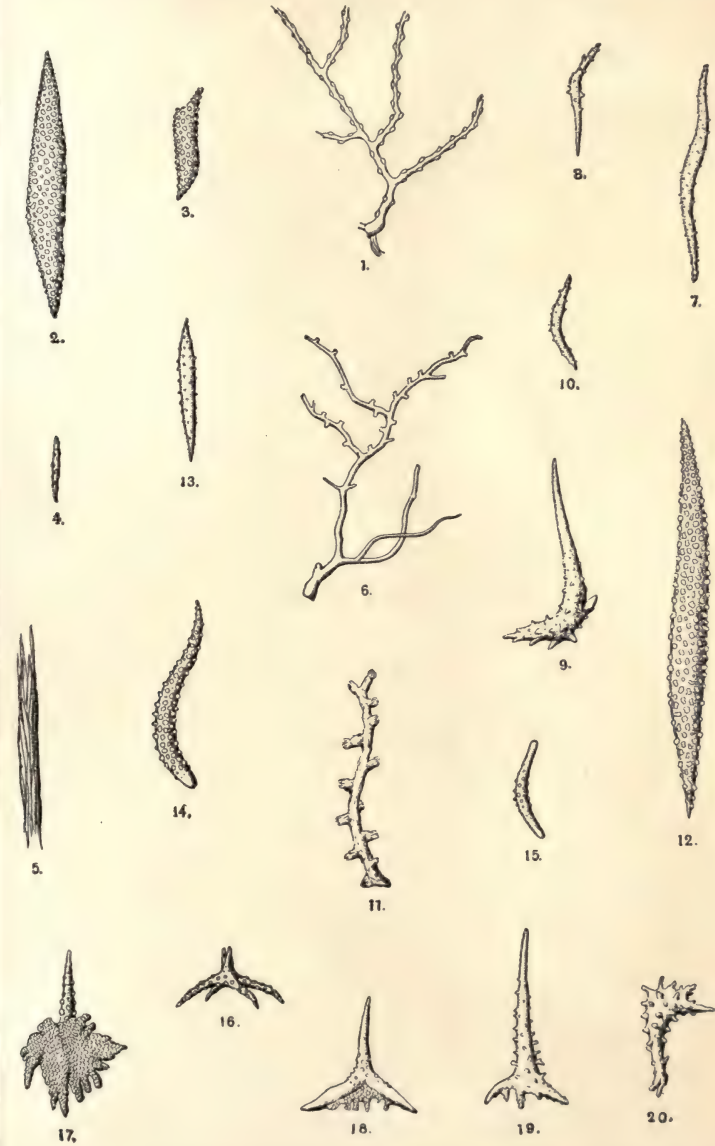
- Fig. 6. Colony. Nat. size.
„ 7. Cortical spicule.
„ 8. Polyp spicule.
„ 9. Coronal spicule.
„ 10. Collar spicule.

Anthomuricea simplex, sp. nov.

- Fig. 11. Colony. Nat. size.
„ 12. Cortical spicule.
„ 13. Deep-seated polyp spicule.
„ 14. Collar spicule.
„ 15. Operculate spicule.

Villogorgia flagellata, sp. nov.

- Fig. 16. Cortical spicule.
„ 17. Polyp spicule.
„ 18. ditto.
„ 19. Coronal spicule.
„ 20. Operculate spicule.



EXPLANATION OF PLATE XVII.

Bebryce studeri, sp. nov.

- Fig. 21. Colony. Nat. size.
„ 22. Cortical spicule.
„ 23. Deep-seated coenenchyma spicule from above.
„ 24. Ditto, in profile.
„ 25. Collar spicule.

Muricella purpurea, sp. nov.

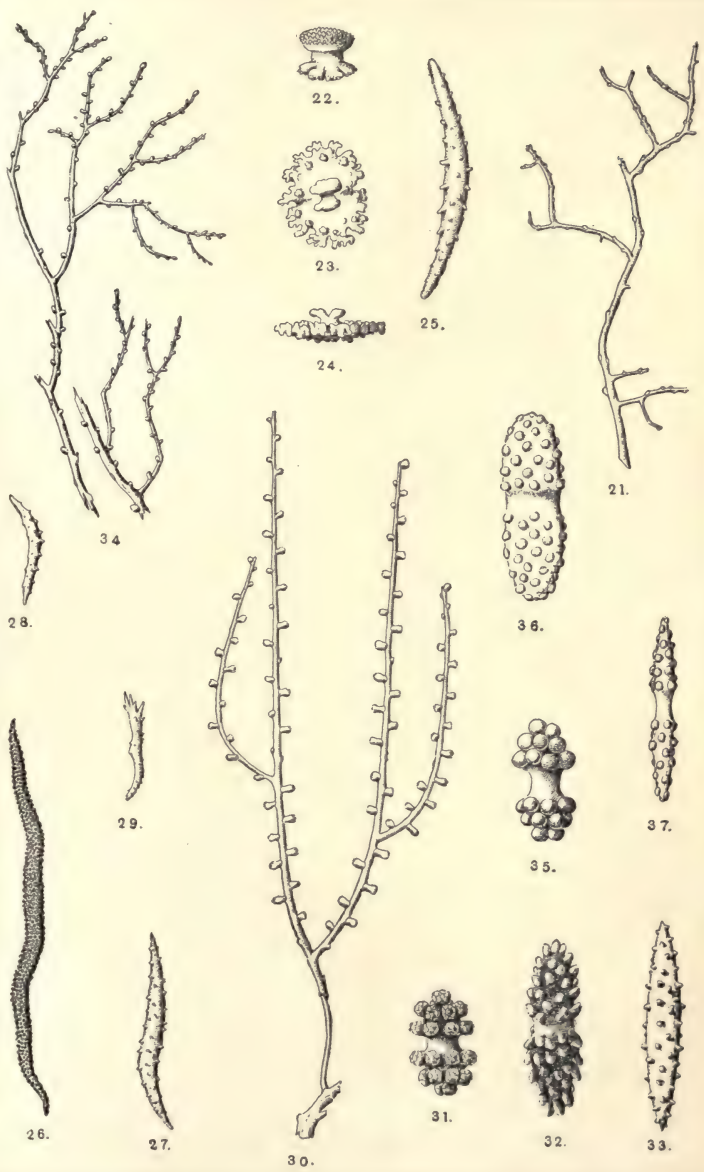
- Fig. 26. Cortical spicule.
„ 27. Polyp spicule.
„ 28. Collar spicule.
„ 29. Operculate spicule.

Nicella laza, sp. nov.

- Fig. 30. Colony. Nat. size.
„ 31. Cortical spicule.
„ 32. Deep-seated coenenchyma spicule.
„ 33. Ditto.

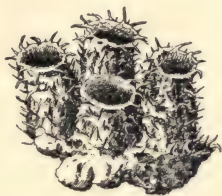
Verrucella flabellata, sp. nov.

- Fig. 34. Colony. Nat. size.
„ 35. Cortical spicule.
„ 36. Deep-seated flattened spicule from the coenenchyma.
„ 37. Ditto, viewed from the side.



EXPLANATION OF PLATE XVIII.

- Fig. 1. *Spinosella glomerata*, sp. nov. Nat. size.
„ 2. *Ciocalypta incrustans*, sp. nov. Nat. size.
„ 3. *Gellins aculeatus*, sp. nov. Nat. size.
„ 4. *Agelas gracilis*, sp. nov., spicule. Greatly enlarged.
„ 5. *Polymastia dendyi*, sp. nov. Nat. size.



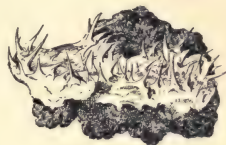
1.



2.



4.



3.



5.



EXPLANATION OF PLATE XIX.

Ptychodera hedleyi, sp. nov.

- Fig. 1. Transverse section through the anterior region of the central proboscis organs. x 65.
- „ 2. Transverse section at the level of the "notochordal" blind sac. x 65.
- „ 3. Transverse section passing through the "end plate" of the proboscis skeleton. x 65.
- „ 4. Transverse section of proboscis neck just in front of the posterior end of the ventral proboscis pocket (*vp.*). x 65.
- „ 5. Transverse section passing through the proboscis pores (*p.*) x 65.
- „ 6. Nearly median sagittal section through the proboscis neck and anterior portion of collar. x 50.

[For Reference Letters see pages 345-6.]

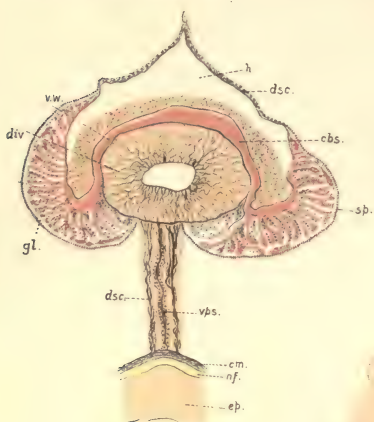


Fig. 1.

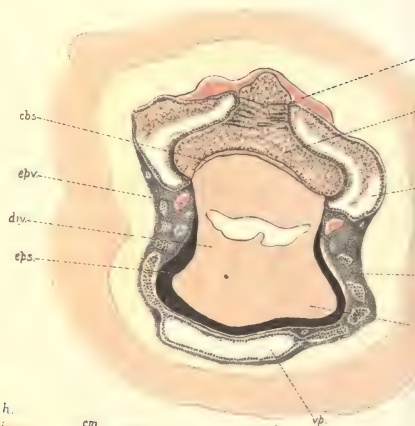


Fig. 3.

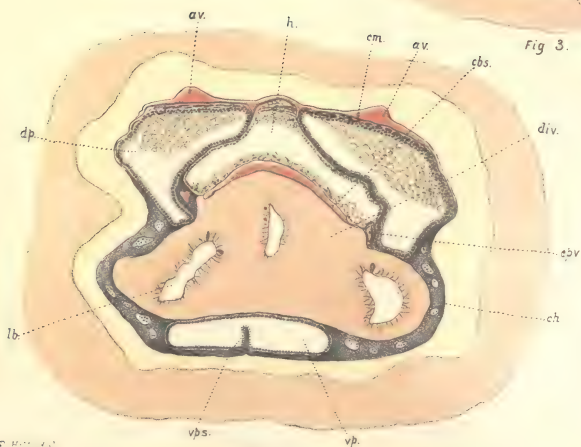


Fig. 2.

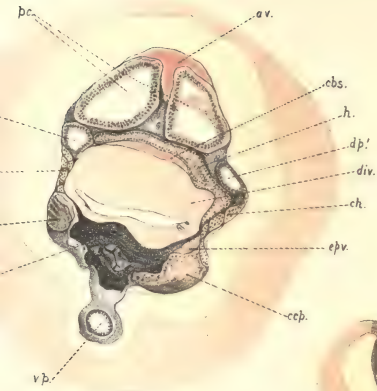


Fig. 4.

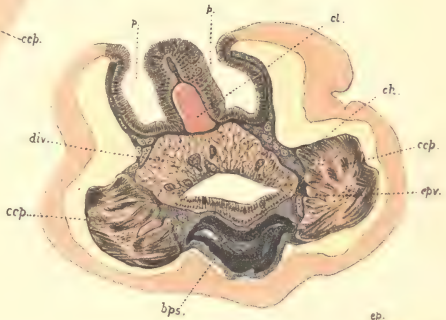


Fig. 5.

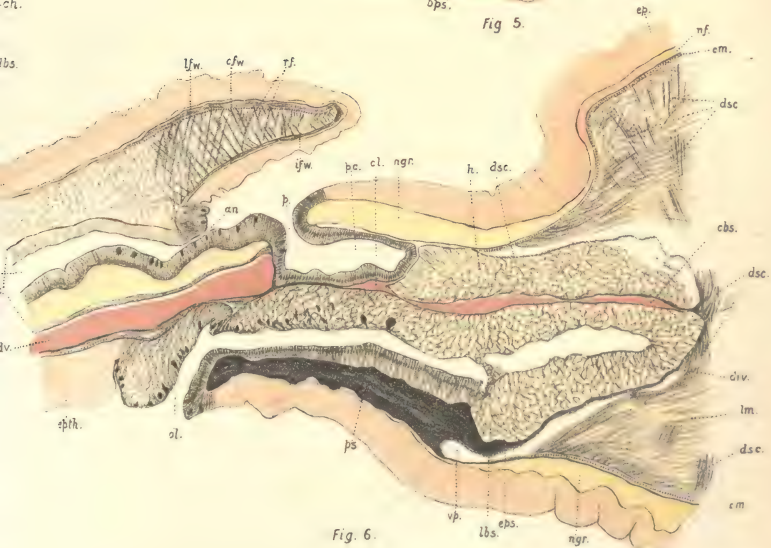


Fig. 6.

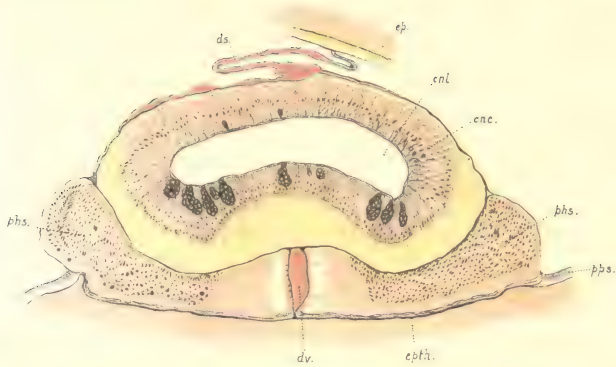


Fig 7.

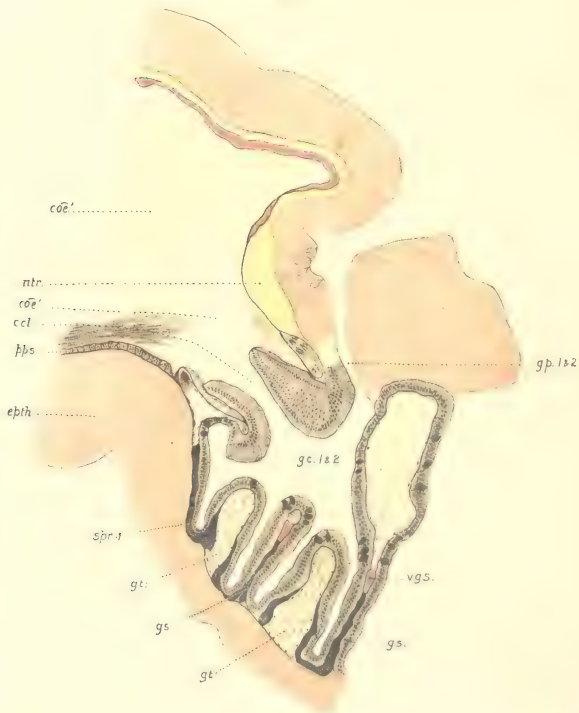


Fig 8

EXPLANATION OF PLATE XX.

Ptychodera hedlehi, sp. nov.

- Fig. 7. Transverse section through the collar nerve cord. x 125.
- „ 8. Sagittal section through the collar canal (*coll.*) of one side and the first and second gill pockets (*gc. 1* and *2*). *gp. 1* and *2*: Common opening of the first and second gill sockets. *spr. 1*: First septal bar of gill skeleton. x 80.

[For Reference Letters see pages 345-6.]



EXPLANATION OF PLATE XXI.

Ptychodera hedleyi, sp. nov.

- Fig. 9. Transverse section through the branchial region; on the left side a gill septum (*gs.*) is shown, and on the right a gill tongue (*gt.*) x 30.
- „ 10. Sagittal section through two gill septa and the gill tongue between. x 135.

[For Reference Letters see pages 345-6.]

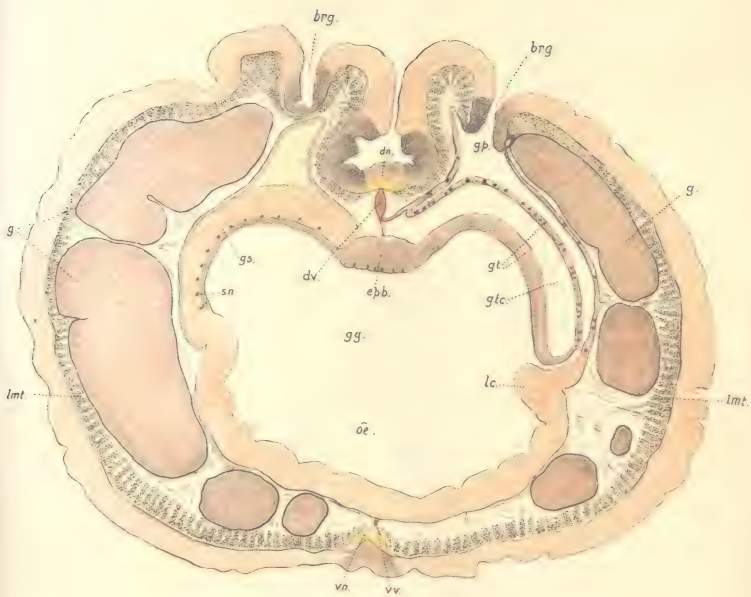


Fig. 9.

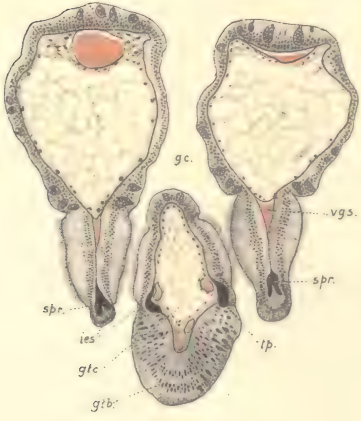


Fig. 10.

EXPLANATION OF PLATE XXII.

Ptychodera hedleyi, sp. nov.

Fig. 11. Transverse section through the anterior portion of the genital region to show the thick walled intestinal diverticulum (*idv.*)
x 24.

„ 12. Transverse section through the middle of the genital region. The genital cushions (*gnc.*) are in this section more approximated than is normal. x 24.

[For Reference Letters see pages 345-6.]

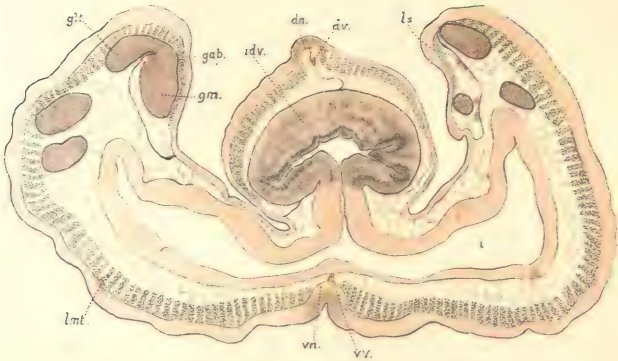


Fig. 11.

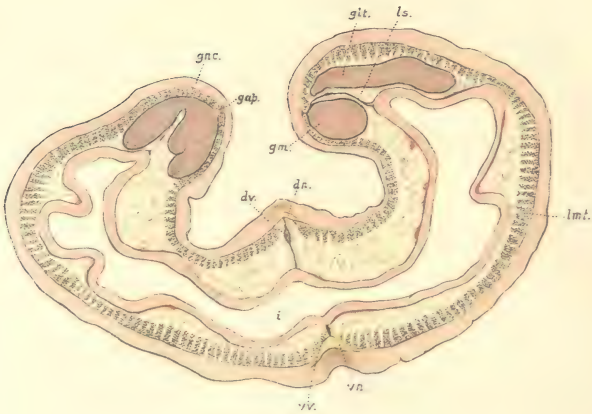


Fig. 12.

THE MADREPORARIA OF FUNAFUTI.

By THOMAS WHITELEGGE.

Zoologist, Australian Museum.

THE MADREPORARIA.

BY THOMAS WHITELEGGE,

Zoologist, Australian Museum.

Mr. C. Hedley furnishes the following note :—

"For one who has surveyed the wealth of life as developed on the great coral reefs of Queensland, New Guinea, or New Caledonia, the chief impression of the coral reef of Funafuti is its poverty. In a single tide one could collect more genera and species on any of the former reefs than an industrious search of several weeks would yield from the latter. Neither is the poverty of species compensated for by an abundance of individuals.

"At the first glance over the windward reef flat, no living corals would probably be seen, but an exploration of the deep cracks and pools near the outer edge would usually reveal a few *Astræa*, *Porites*, and others, sheltered from the blows of the surf.

"A better field for observation is provided by the small reefs which stud the lagoon. Two or three of these, just in front of the village, and from a quarter to half a mile from the shore, yielded much of the material now dealt with.

"On approaching a coral reef the first glimpse a naturalist usually has of his quest are the great hemispherical masses of some Astrean coral, dimly seen through the shoaling water, studding the sea floor. If the boat passes a submarine ledge, from its face are sure to project the large basin or bracket-shaped corallia of *Montipora*, sometimes in clusters like a group of huge sea mushrooms. Jumping overboard in shallow water he is likely to step on a flat tabular mass of pale purple, whose corallites are too small to be distinguished in the water. Applying hammer and chisel, he will find that at his first venture he has struck the hardest, toughest, and most unbreakable thing on the whole reef, a *Porites* block. From the *Madrepora* bush beside it his difficulty, on the contrary, is to convey his samples ashore intact. The stout limbs of red, yellow, or green *Pocillopora* or *Stylophora* snap easily; while a skull-shaped mass of *Astræa* will split along the grain. A fragile little coral is the *Pocillopora cæspitosa*, which grows in dainty little pink tufts here and there among the stones. *Fungida* were very uncommon on Funafuti; I only picked up one alive and saw a few others dead on the western side of the atoll.

Where the soft *Alcyonaria* luxuriate, hard corals do not occur: the latter are perhaps smothered by their rivals.

"Dead corals thrown up on the outer beach suggested a distinct deep-water fauna that was beyond my reach. One of these is *Mussa*. Another much battered species of which I preserved no examples was frequently seen on the outer beach of both Funafuti and Nukulailai, I suppose to be a *Tridacophyllia*.

"Noticeable for their absence were the genera *Galaxea*, *Turbinaria*, *Merulina* and *Dendrophyllia*.

"The usual method of collecting was to anchor a boat or canoe on a reef, wade round in water from knee to waist deep and break off with a hammer and chisel any attractive specimens. Size and colour, the least stable of characters, chiefly guided me in such selection. With many genera a specialist in his study separates with difficulty the species by microscopic characters. When a non-specialist in the field views specimens through several feet of water, it is obvious that he must often confound together distinct species, and therefore fail to collect what he ought to take. Mr. Whitelegge has so frequently recognised two species in material that had been chosen as illustrating one, that I am not now as confident of the completeness of the collection as I was on my departure from Funafuti."

The Madreporarian corals obtained by Mr C. Hedley at Funafuti consist of one hundred and seventy specimens, referred to forty-seven species, and include representatives of nineteen genera.

The larger portion of the collection comprises the usual forms common throughout the coral regions; there are, however, a few rare or little known species not hitherto recorded from the Pacific, and also two species and one variety apparently new to science.

In the following pages, a few of the rarer forms have been described at some length, and in many cases, when dealing with the surface echinulations, I have given micrometric measurements of the average distance apart at the apex. It appears to me that the echinulations, if carefully measured in each species, would afford a fairly constant specific character which has hitherto been neglected.

The measurements given herein have been taken from the younger portions of the corallum. The echinulae are generally a little compressed, at least at the base, and the micrometre lines have been brought parallel with the compression, but the measurements have been taken from the apices.

Of course there is a considerable amount of variation in the distance apart at the apex, owing to the bending of the echinulae,

or to secondary spinular growths at the summits, but the average distances, when numerous measurements are taken, prove to be pretty constant and equally as reliable in corals as in other organisms determined by micrometric measurements.

The species described as new are *Madrepora spinulifera* and *M. impressa*. The former is referable to the subgenus *Odontocyathus* and the latter to the subgenus *Isopora*.

Order MADREPORARIA APOROSA.

FAMILY TURBINOLIDÆ.

CARYOPHYLLIA CLAVUS, var. EPITHECATA, *Duncan*.

Caryophyllia clavus, var. *epithecata*, Duncan, Trans. Zool. Soc., viii., p. 311, pl. xlviii., figs. 13–16.

A small immature example in the collection is referable to this variety.

The corallum is erect, elongate, conico-turbinate, incrusting at the base and elliptic in outline at the summit.

The epitheca is finely granulate and extends from the base to the calicular margin.

The costæ are slightly prominent above, and cease at the median constriction below.

The septa are strongly exerted, radiately granulose at the sides and evenly rounded at the summits.

The pali are sinuate and sparsely spinose.

The columella consists of two spirally twisted processes.

There are forty septa and ten pali. The latter are opposite the tertiaries.

Height of corallum 14 mm.

Diameter at apex 7 by 9 mm.

„ base 7 mm.

„ pedicel 3 mm.

Obtained in from forty to seventy fathoms.

FAMILY OCULINIDÆ.

STYLOPHORA DIGITATA, *Pallas*.

Stylophora digitata (Pallas), Klunzinger, Die Korall. Rothen. Meeres, p. 61, pl. v., fig. 5; pl. viii., fig. 1.

There are eight examples of this species, exhibiting considerable variation.

In the young the branches are subcylindrical, transversely nodose, and somewhat conical at the extremities. The larger

specimens are mostly round symmetrical clumps, with compressed branches and obtusely rounded summits.

Common in the shallow waters of the lagoon.

FAMILY POCILLOPORIDÆ.

POCILLOPORA CÆSPITOSA, Dana.

Pocillopora cæspitosa, Dana, Zoophytes, U.S. Explor. Exped., p. 525, pl. xlix., fig. 5.

Three specimens of this common form are in the collection. It was the most abundant coral in the lagoon. The colour was pale rose when alive. Native name "Kamu."

POCILLOPORA GRANDIS, Dana.

Pocillopora grandis, Dana, Zoophytes, U.S. Explor. Exped., p. 533, pl. li., fig. 2.

Five examples; the largest is subflabellate, the branches being from 9 to 17 cm. thick. Bright emerald green when alive.

Uncommon in the lagoon.

POCILLOPORA VERRUCOSA, Ellis & Solander.

Pocillopora verrucosa, Ellis & Solander, Nat. Hist. Zoophytes, p. 172.

Four specimens.

Frequent in the lagoon and on the ocean shore.

FAMILY ASTRÆIDÆ.

MUSSA COSTATA, Dana.

Mussa costata, Dana, Zoophytes, U.S. Explor. Exped., p. 179, pl. vii, fig. 2.

Three water-worn fragments which may possibly belong to this species.

CÆLORIA ESPERI, Edwards & Haime.

Cæloria esperi, Edwards & Haime, Hist. Nat. Corall., ii., p. 417.

Seven examples of this species are in the collection.

Common in the lagoon, and on the outer reefs.

HYDNOPHORA MICROCONIA, Lam.

Hydnophora microconia, Lam., Hist. Anim. sans Vert., ii., 1816, p. 251.

Three specimens obtained on the lagoon reefs.

ASTRÆA VERSIPORA, Dana.

Astræa versipora, Dana, Zoophytes, U.S. Explor. Exped., p. 233, pl. xii., fig. 5.

Four large specimens.

Very common at low water in the lagoon and on the outer reefs.

ASTRÆA DANÆ, *Edwards & Haime*.

Favia danæ, Edwards & Haime, Hist. Nat. Corall., ii., p. 442.

Astræa porcata, Dana, Zoophytes, U.S. Explor. Exped., p. 226, pl. xi., fig. 5.

One specimen.

Common in the lagoons and on the outer reefs.

ASTRÆA DENTICULATA, *Ellis & Solander*.

Madrepora denticulata, Ellis & Solander, Nat. Hist. Zoophytes, p. 166, pl. xlix., fig. 1.

Four specimens.

Abundant on the reefs.

ACANTHASTRÆA PATULA, *Dana*.

Acanthastræa patula, Dana, Zoophytes, U.S. Explor. Exped., p. 209, pl. x., fig. 14.

One small example.

The calicles are subcircular, oblong, or polygonal and very unequal in the size of the fossa, and also in the relative thickness of the walls. The former measure from 5 to 10 mm. in diameter, the latter from 2 to 6 mm. in thickness. The septa vary in number from twelve to thirty-six.

The columella consists of a series of compressed denticles, frequently more or less connected.

Among loose stones on the lee side of the atoll.

ACANTHASTRÆA ECHINATA, *Dana*.

Acanthastræa echinata, Dana, Zoophytes, U.S. Explor. Exped., p. 229, pl. xii., fig. 1.

A single specimen in spirit is in the collection.

The larger calicles are about 9 mm. in diameter. The third cycle of septa is incomplete. The septal spines are from 2 to 3.5 mm. in height.

Colour dark blackish brown.

Occurring with the preceding.

LEPTASTRÆA SOLIDA, *Edwards & Haime*.

Leptastræa solida, Edwards & Haime, Hist. Nat. Corall., ii., p. 512, pl. D 8, fig. 2.

Four specimens of this species were obtained. All are incrusting and assume the shape of the object they have invested, forming irregular nodular masses without any points of attachment.

Occurring among loose stones on the lee side of the reef.

LEPTASTRÆA TRANSVERSA, *Klunzinger*.

Leptastræa transversa, Klunzinger, Die Korall. Rothen. Meeres, iii., 46, pl. vi., fig. 2.

Three examples.

Incrusting, forming irregular convex plates on dead coral.

CYPHASTRÆA DANÆ, *Edwards & Haime*.

Cyphastræa danæ, Edwards & Haime, Hist. Nat. Corall., ii., p. 487.

Astræa microphthalmia, Dana, Zoophytes, U.S. Explor. Exped., p. 217, pl. x., fig. 11.

One small example, consisting of a thin incrusting living layer growing on a dead crust of the same species, which completely invests some foreign object.

In the central region of the corallum the calices are contiguous, the walls being frequently in contact with each other; near the margin they are separated by narrow spaces about half their own diameter.

The calices are from 1.5 to 2 mm. in diameter, they are prominent, and have the walls and septa exserted.

The costæ and intercalicine spaces are finely echinulate. The echinulæ are from 0.15 to 0.2 mm. apart.

The columella is small, and consists of from three to six sub-spiniform granules.

Obtained in the passage between the islets of the reef.

Order MADREPORARIA FUNGIDA.

FAMILY PLESIOFUNGIDÆ.

PAVONIA REPENS, *Bruggemann*.

Lophoseris repens, Bruggemann, Abhandl. naturw. vereins zu Bremen, v., p. 395, pl. vii., fig. 1, a-b.

Pavonia repens, Klunzinger, Korall. Rothen. Meeres, 1879, p. 75, pl. ix., fig. 3.

Three specimens.

Obtained by a native diver in twenty feet of water in the lagoon.

Colour dull dark brown.

PAVONIA EXPLANULATA, *Lam.*

Pavonia explanulata, Lam., Anim. sans Vert., ii., 1816, p. 244; Edwards & Haime, Hist. Nat. Corall., iii., p. 69, pl. d 11, fig. 2.

Two small incrusting specimens were obtained in the lagoon.

FAMILY CYCLOSERIDÆ.

PSAMMOCORA FOSSATA, Dana.

Psammocora fossata, Dana, Zoophytes, U.S. Explor. Exped., p. 347, pl. xxvi., figs. 2, 2a.

Two specimens: one explanate, convex, with a large free epithecate margin exhibiting concentric lines of growth on the lower surface; the other a roll-like form incrusting a dead piece of coral. The meandering calicine valleys are mostly short, containing from two to six calicles; near the margins of the corallum as many as twelve may be found in one valley.

The ridges are rounded, and somewhat strongly echinulate. The septa vary in number from twelve to thirty-six; their summits are thick and echinulate. The echinulæ are arranged transversely in subquadrate groups, about 0.2 mm. apart at the apex.

The columella is small, and consists of a few spiniform granules.

Obtained in the lagoon.

PSAMMOCORA CONTIGUA, Esper.

Madrepora contigua, Esper, Die Pflanz., i., 1797, Suppl., p. 81, pl. lxvi.

Psammocora plicata, Dana, Zoophytes, U.S. Explor. Exped., p. 346, pl. xxv., fig. 2.

Two fine specimens of this species were obtained at low tide mark on the western side of the atoll.

OXYFORA, sp.

A small fragment was obtained in from forty to seventy fathoms outside the atoll. Its condition, however, is such as to preclude the possibility of specific identification.

FAMILY FUNGIDÆ.

FUNGIA TENUIDENS, Quelch.

Fungia tenuidens, Quelch, Chall. Rep., Zool., xvi., p. 138, pl. vi., fig. 1.

One example, similar in size, shape, and general characters to the specimen figured in the "Challenger" Report.

Occurring on the western side of the atoll.

FUNGIA DISCUS, Dana.

Fungia discus, Dana, Zoophytes, U.S. Explor. Exped., p. 291, pl. xviii., fig. 3.

A single beach-worn example is referable to this species.

Western side of the atoll.

MADREPORARIA PERFORATA.

FAMILY MADREPORIDÆ.

MADREPORA SYRINGODES, *Brook*.

Madrepora syringodes, Brook, Cat. Madr. Corals, Brit. Mus., i., p. 177, pl. xxxiii., fig. E.

Two small examples are somewhat doubtfully referred to this species.

MADREPORA SPICIFERA, *Dana*.

Madrepora spicifera, Dana, Zoophytes, U.S. Explor. Exped., p. 442, pl. xxxiii., fig. 4.

A single specimen, consisting of a stout pedicel and two plate-like lobes, one of which is much larger than the other; the irregular shape appears to have been due to the corallum growing in a narrow passage subject to strong inrushing currents of water. The lower surface near the pedicel is destitute of corallites except near the margins and angles of the branches on which there exist a few scattered immersed corallites. Towards the extremities of the branches the surface bears distinct immersed and subimmersed corallites.

The echinulæ on the upper and lower surface consist of compressed processes, usually wider at the summit than at the base, and on an average are about 0.15 mm. apart.

The striæ on the radial and axial corallites are about 0.1 mm. apart.

Collected on the outer reef, south-east of the main islet.

MADREPORA BOTRYODES, var. FUNAFUTIENSIS, var. nov.

Madrepota botryodes, Brook, Cat. Madr. Corals, Brit. Mus., i., p. 153, pl. xxxiv., fig. c.

A single example, referable to this species, but differing sufficiently to merit a varietal name.

The corallum is 12 cm. high, 28 cm. long, and from 9 to 12 cm. broad. The main branches are about 7 cm. high and 1.5 cm. in diameter; they are angular below, and give off from two to six branchlets, which reach the same level. The apices of the branchlets are irregularly thickened by aggregations of proliferous corallites. The branchlets are about 1.2 cm. in diameter at the base, and from 1 to 2.5 at the summit; at the apex they are 2 cm. apart and are separated below the clustered corallites by spaces 5 mm. wide.

Axial corallites from 2 to 3.5 mm. in diameter and 2 mm. exsert, aperture about 0.8 mm., septa twelve, the primaries meeting at the base; the secondaries are very narrow at the margin.

Radial corallites extremely variable in shape and in distance apart. On the lower parts of the main branches they are distant and deeply immersed; in the angles between the branchlets they are crowded, immersed, or slightly verruciform; on the lower two-thirds of the branchlets they are appressed, half tubular, and have the apertures directed upwards.

The clustered radials at the summits of the branchlets are immersed or subimmersed, passing through shallow nest-shaped to beak-nariform, with an elongated aperture. They are so irregularly heaped together that the axial corallites become obscured. The largest are about 3 mm. in length and 2.5 mm. in diameter.

There are twelve well developed septa. The primaries and also the directives in the elongate forms are broad and frequently meet below.

The surface, including the corallite walls is closely echinulate. The echinulae consist of flat plates, often denticulated and wider at the apex than at the base. They are about 0.12 mm. apart.

Reefs in the lagoon.

MADREPORA PATULA, *Brook*.

Madrepora patula, Brook, Cat. Madr. Corals, Brit. Mus., i., 1893, p. 111, pl. ix., fig. E.

One fine example of this species in the collection.

Reefs in the lagoon.

MADREPORA EFFLORESCENS, *Dana*.

Madrepora efflorescens, Dana, Zoophytes, U.S. Explor. Exped., p. 441, pl. xxxiii., fig. 6.

A young specimen, referable to this species, was obtained in the lagoon.

The base is incrusting, and forms a discoidal expansion 12 cm. in diameter. At the origin of the pedicel it is 2 cm. thick, thinning down to 2 or 3 mm. at the margin. The pedicel is 6 cm. in diameter, and 2 cm. in height. The branches number between forty and fifty; inferiorly they are all more or less fused, superiorly their apices are free; about 1 cm. in height and pretty regularly the same distance apart at the apex. Their diameters range between 5 and 10 mm.

The corallites on the expanded base are nariform or tubonariform, with numerous immersed ones between. They are 2 mm. in diameter, the same or less in height, and about 2.5 mm. apart. The outer wall is more or less wanting.

The corallites on the pedicel and the lower parts of the branches are longer, stouter, and farther apart than those on the base. The

inner walls are short and the immersed corallites are more numerous.

Radial corallites of the branchlets and of the central region are labellate or tubo-labellate; they are longer and narrower than those on the under surface. They average about 1 mm. in diameter and vary from 2 to 3 mm. in height.

The axial corallites are from 2 to 2.5 mm. in diameter and are 2 mm. exert. The septa of the axial corallites are twelve, the primaries are well developed, and the directives meet below. In the radials of the upper surface there are usually only six septa; the directives are a little broader than the rest. On the lower surface of the branches, pedicel, and base, the septa are in two cycles, the primaries broad, the secondaries narrow, and the directives meet at the base.

Echinulæ flat; denticulate plates 0.1 mm. apart.

On the upper surface of the corallum the ridges on the walls of the corallites are 0.2 mm. apart; on the lower they are about 0.15 mm. Each ridge, when unabraded, has two longitudinal rows of spinules, which arise from the crest on either side; they are opposite or alternate, and diverge at such angle as to project over the interstices between the ridges.

Reefs in the lagoon.

MADREPORA FRUTICOSA, *Brook.*

Madrepora fruticosa, Brook, Cat. Madr. Corals, Brit. Mus., i., p. 138, pl. xviii., fig. A.

One small specimen obtained on the reefs in the lagoon.

MADREPORA EURYSTOMA, *Klunzinger.*

Madrepora eurystoma, Klunzinger, Die Korall. Rothen. Meeres, ii., p. 16, pl. i., fig. 8, pl. iv., fig. 7, a, b, pl. ix., fig. 12.

One specimen obtained in the lagoon.

The corallum is subcorymbose, and is attached by an incrusting base to a dead specimen of the same species. The living portion is 10 cm. high, and 14 cm. in diameter. The stouter main branches are angular, often compressed and fused at the base, varying from 1 to 2 cm. in thickness; towards their summit they give off numerous short simple branchlets, usually about 2.5 cm. in length, 4 to 5 mm. in diameter, and 1 to 2 cm. apart at the apex. They are fairly uniform in diameter, except the apical third which tapers to the base of the axial corallite.

The basal corallites are immersed or subimmersed; the septa are in two cycles, both narrow at the summit; the primaries become broader below and often meet in the centre.

The radial corallites on the basal portions of the branches and branchlets are immersed, or short and verruciform towards the

summits; they are funnel-shaped, 2.5 mm. in diameter, 1.5 to 3 mm. in length, with an aperture of about 1 mm. Corallite walls porous, faintly striate, and denticulate; the striæ 0.2 mm. apart, the denticles 0.15. Outer margin stout, inner thin, rarely incomplete except near the summits of the branchlets.

Axial corallites 2 to 3.5 mm. in diameter, 2 mm. exsert, with thin walls, a large aperture, and twelve septa, narrow above and broad below.

MADREPORA SPINULIFERA, sp. nov.

Corallum prostrate, openly reticulate; mesh from 2 to 3 cm. long, and 1 cm. wide. Main branches angular, 1 cm. in diameter. Under surface without branchlets, upper with a series of short ones set at an angle of fifty degrees and directed outwards; they are 5 mm. in diameter at the base, 1.5 cm. in height, and 1.2 cm. apart at the apex. Inner branchlets simple or with incipient twigs, tapering a little to their frequently compressed apices. Outer branchlets subcylindrical and more or less proliferous near their summits.

Corallites of the under surface of the branches immersed or subimmersed, becoming depressed nariform a short distance from the extremities; they are about 2 mm. apart, 1 mm. or less in diameter, and have a round or oval aperture.

Calicles very deep, with twelve septa all narrow except the directives, which are broad and but rarely meet below. The secondaries are occasionally rudimentary in the young corallites.

The corallites of the upper surface of the branches and bases of the branchlets are similar to those on the under, but are wider apart, usually about 3 mm.

Radial corallites of the branchlets nariform, compressed inner wall often incomplete, tubo-nariform only in buds destined to form branchlets; aperture oblique, opening upwards, longer than broad or more frequently twice as long as broad; septa six, the directives large; length 2 to 3 mm., diameter 2 mm. at the base.

Axial corallites compressed; 1.5 mm. in their shorter and 2.3 in their longer diameter; aperture elliptic, frequently narrowed in the middle.

Septa in two cycles, the secondaries narrow, the directives broad and nearly meeting below.

Surface of corallum porous, minutely spinulose; spinules compressed, acute at the apex, 0.2 mm. high and about the same distance apart. Corallite wall thin, porous within and without, striate; the striæ 0.14 mm. apart; base and marginal lip beset with spinules similar to those on the rest of the surface; intermediate portion of wall with spiniform granules.

There are eight pieces, evidently detached from one large specimen ; the largest is 12 cm. in length, and 7 cm. broad at the outer extremity.

Reefs in the lagoon.

MADREPORA IMPRESSA, sp. nov.

One example obtained in the lagoon.

Corallum consisting of a subreniform plate, spreading out from a lateral attachment ; the plate is 30 cm. long, from 14 to 20 cm. broad, 11.5 cm. thick at the point of attachment, from thence thinning out gradually to 1 cm. or less at the margin.

The living layer, as in other species of the subgenus *Isopora*, is about 1 cm. in thickness. The under surface is smooth and destitute of corallites. The basal epitheca is marked by a series of concentric ridges, indicating the lines of growth.

Upper surface very uneven, covered with low, irregularly rounded elevations, 1 cm. in diameter, 5 mm. high, and usually about 7 mm. apart. The intervening depressions vary in shape from subcircular to elongate, the latter form occurring near the margins, where the elevations are more or less connected by narrow ridges. Besides the numerous small prominences, there are six or seven larger ones from 2 to 3 cm. high and 3.5 cm. in diameter.

A few obtuse, compressed, or subquadrate branches are present near the margin, the largest is 3 cm. in height and 1.5 cm. in diameter.

Axial corallites numerous, situated in groups on the elevations, from 1.5 to 2 mm. in diameter ; aperture circular, small, rarely exceeding 0.7 mm., generally between 0.5 and 0.6 mm. in diameter ; walls 0.6 to 0.7 mm. in thickness, often confluent to the summits, which are plane or but little rounded.

Septa in two cycles, the directives seldom more than 0.1 mm. broad at the margin and about 0.15 at the base, the remaining primaries are very narrow, the secondaries barely distinguishable.

Radial corallites crowded, frequently confluent, subimmersed, nariform, tubo-nariform, or tubular ; inner part of wall occasionally incomplete. Apices rounded, but generally thin and denticulate at the margin ; diameter about 1.5 mm., length up to 2.5 mm.

The second cycle of septa either absent or rudimentary, primaries similar to those of the axial corallites.

Corallite walls densely covered with compressed denticulate echinulations, 0.15 mm. high and about 0.1 mm. apart.

The echinulations are more closely packed than in any of the described species known to me. The following measurements of the echinulations on the younger parts of the corallum and on the corallite walls have been taken from specimens in the Museum collection :—

	Height of echinulæ.			Distance apart.	
<i>M. hispida</i> ...	...	0·2 mm.	...	...	0·18 mm.
<i>M. plicata</i> ...	...	0·17 "	...	...	0·13 "
<i>M. palifera</i> ...	...	0·17 "	...	...	0·12 "
<i>M. cuneata</i> ...	...	0·15 "	...	...	0·15 "
<i>M. impressa</i> ...	...	0·15 "	...	...	0·1 "

ASTRÆOPORA INCRUSTANS, *Bernard*.

Astræopora incrustans, Bernard, Cat. Madr. Corals, Brit. Mus., ii., p. 89, pl. xxvii., pl. xxxiii., fig. 10.

A fine example of this species is in the collection.

The corallum forms a slightly convex plate, 17 cm. broad, 20 cm. long, and from 1 to 2 cm. in thickness.

Outline irregularly elliptic, margin pendant on one side obscuring the epitheca, on the other subhorizontal, the epitheca being radiately scalloped and concentrically ridged. The calices are separated by spaces about 3 mm. wide. The walls are low, inclined in various directions, one side often flush with the surface, the other more or less elevated; diameter of the aperture usually about 2·5 mm., rarely 3·5.

Interclated young and marginal calices smaller, varying from 1 to 1·5 mm.

Septa in two cycles, with an incomplete third, usually perceptible at the margin, but very narrow. The primaries rapidly widen out towards the base of the fossa.

Surface porous and echinulate; the echinulæ are flat denticles about 0·5 apart at the apex.

ASTRÆOPORA OCELLATA, *Bernard*.

Astræopora ocellata, Bernard, Cat. Madr. Corals, Brit. Mus., ii., p. 95, pl. xxix., pl. xxxiii., fig. 16.

There are two fine examples of this species; both are pulvinate and attached to dead specimens of the same form.

The larger corallum is 12 cm. broad, 23 cm. long, and about 10 cm. in thickness.

The submarginal calices are large, prominent, with solid sloping walls and regular radiating rows of plate-like echinulæ, tipped

with spinules; the plates are about 0.4 mm. apart at the lip, and 0.5 mm. at the base of the wall.

The calicles on the central region of the corallum are not so large as those near the margin; they are less prominent, with but little sloping walls, and packed so closely together that the echinulations are almost in contact at their apices.

The corallites measure from 4 to 6 mm. in external diameter; the aperture is usually circular, and from 2 to 3 mm. across; frequently where the corallites are crowded, the aperture is elliptic or narrow elongate, and twice as long as broad.

The septa are in two cycles, with an incomplete third; they are narrow and ill-defined at the margin. Towards the base of the fossa the primaries widen out and meet in the centre.

Obtained on the lagoon reefs.

ASTRÆOPORA HIRSUTA, Bernard.

Astræopora hirsuta, Bernard, Cat. Madr. Corals, Brit. Mus., ii., p. 94, pl. xxxiii., fig. 13.

There are three examples referable to this species.

The larger is 25 cm. long, 8 cm. broad, and 7 cm. thick. The upper surface irregular in shape and almost divided into three cushion-like masses; the under surface is flattened, and a thin layer extends a short distance along a dead colony of the same species.

The corallites are rarely raised above the rest of the surface; the aperture is about 2 mm. in diameter, the spaces between are about the same, rarely more but frequently less.

The septa are in two cycles, well defined at the margin, the primaries meeting below.

The surface is closely echinulate; the echinulae are usually compressed, single-pointed, and about 0.45 mm. apart.

The septo-costal and synapticular elements frequently combine and form a reticulated lip round the apertures of the corallites.

Reefs in the lagoon.

MONTIPORA FOVEOLATA, Dana.

Montipora foveolata, Dana, Zoophytes, U.S. Explor. Exped., p. 507.

There are three specimens referable to this species, one of which is a remarkably fine example, 28 cm. high and 26 cm. in diameter.

The base is somewhat flattened, subcircular in outline, and 22 cm. in diameter; it exhibits zones of growth enclosing dead material, probably of the same species.

The whole of the living layer appears to be incrusting, about 1 cm. or less in thickness, and is characterised by an extremely uneven surface, beset with numerous irregular nodular elevations. The larger elevations are from 5 to 6 cm. in diameter and about the same in height; the smaller are about 3 cm. in diameter and 2.5 cm. high; they are scattered over the whole surface of the corallum.

The apertures of the corallites are situated at the bottom of deep funnel-shaped pits; they are about 1 mm. or less in diameter. The raised cœnenchymatous walls are confluent, with thin, acute, or rounded margins. They range between 1 and 2 mm. in diameter at the summits, and are about the same in height.

The surface is finely porous and echinulate; the echinulæ are usually compressed and single-pointed; they are about 0.17 mm. high, and the same distance apart.

There are twelve well developed septa; the primaries are usually 0.3 mm. broad at the margin and meet in the centre below; the secondaries are narrower, about 0.2 mm., and are often united to the primaries near the columella.

MONTIPORA VERRUCOSA, Lam.

Montipora verrucosa, Lam., Hist. Anim. sans Vert., ii., p. 271, 1816.

Montipora planiuscula, Dana, Zoophytes, U.S. Explor. Exped., p. 507, pl. xlvii., fig. 3.

There are three specimens of this species, all of which are incrusting, forming irregular convex cushion-shaped masses.

The largest example is broken; it is 22 cm. long, 10 cm. broad, and 3 cm. thick, thinning down to about 7 mm. at the pendant margin.

The calices are deeply sunk between the elevated papillæ; they are usually about 1 mm. in diameter, possessing a very distinct star of twelve septa; the secondaries, although narrow at the margin, frequently reach and unite with columella like the primaries. A few of the larger calices, near the centre of the corallum, have an incomplete third cycle.

The papillæ are absent on the under surface; on the upper they are very variable in size; in some parts they are thin, compressed, and confluent at the base, in others they are thick, high,

and semi-isolated or united in twos or threes, forming short ridges. The apices are all more or less rounded; they are about 2 mm. in diameter, 1 to 3 mm. high, and 2.5 mm. apart at the apex.

The surface is finely echinulate; the echinulae are compressed, single or double pointed spinules, about 0.13 mm. high and 0.1 mm. apart.

Obtained on the lagoon reefs.

MONTIPORA TUBEROSA, Klunzinger.

Montipora tuberosa, Klunzinger, Die Korall. Rothen. Meeres, p. 32, pl. vi., fig. 6, pl. v., fig. 11, pl. x., fig. 3.

A very fine specimen is here somewhat doubtfully referred to this species.

The corallum consists of a foliate expansion, arising from a stout lateral pedicel.

The frond is concave above, and exhibits a series of wide shallow grooves, which radiate from the centre of the concavity to the margin. On the under surface the grooves are more sharply defined, as are also the ridges occurring between.

The pedicel is 13 cm. in diameter; the frond is 46 cm. long, 40 cm. broad, 2 cm. thick near the pedicel, and from 2 to 3 mm. at the margin. The latter is broken on one side. When complete, the outline would be nearly circular and 50 cm. in diameter.

The upper surface is very uneven; there are a few large mound-like elevations, a number of small ones, and the whole surface exhibits inequalities due to clusters of from three to six or more corallites which are more or less elevated above the others.

The corallite apertures are 0.7 mm. in diameter; they are surrounded by thin trabicular walls, tipped with from two to five echinulated spines; they rarely form a circle round the lip, and are generally wanting on one side.

The septa are in two cycles, the directives are broad and meet below, the secondaries are narrow and subequal to the rest of the primaries.

There are a few large corallites scattered on the surface in which an incomplete third cycle of septa is present.

The under surface of the corallum has a living layer at the margin, varying from 2 to 12 cm. in width. It exhibits a broad

band of low rounded tubercles, 3 to 4 mm. diameter, 2 to 4 mm. high, and about 5 mm. apart at the apex.

The calicles are either level with the surface or slightly depressed; they are 0.5 in diameter, and vary greatly in distance apart.

The cœnenchyma is comparatively smooth and marked with a vermicular reticulation.

The echinulæ on the upper surface are slightly compressed at the base, above they are somewhat irregular and bear numerous acute spinules; they are from 1 to 2.5 mm. in height and about 0.5 mm. apart.

MONTIPORA SCABRICULA, Dana.

Montipora scabricula, Dana, Zoophytes, U.S. Explor. Exped., p. 502, pl. xlv., fig. 2.

One small specimen which may be referred to this species; the fragment is, however, too much worn for correct determination.

Lagoon shore.

MONTIPORA EXSERTA, Quelch.

Montipora exserta, Quelch, Chall. Rep. Zool., xvi., p. 174, pl. viii., fig. 5-5b.

There are two specimens of this well marked species; one is small, flat, incrusting, and measures 5 cm. in length, 3.5 cm. in width, and 9 mm. in thickness at the broken edge; the other is cushion-shaped, 13 cm. long, 7 cm. broad, and 2 cm. thick, with a very even surface studded with numerous wart-like elevations. The surface is perforated here and there by a boring mollusc, which may be the cause of the warty growths. The calicles are between 0.65 and 0.75 in diameter and about the same distance or more apart. The apertures on the level parts of the corallum are surrounded by a very shallow rim, and all the septa are more or less exserted. The directives are broad and have their inner apices higher than the outer. The septa are usually in two cycles. A few large calicles are present in which a third cycle is more or less complete.

The surface of the cœnenchyma is reticulate, porous, and minutely echinulate. The echinulæ vary considerably; on the higher parts they chiefly consist of spiniform granules. On rapidly growing parts and at the margin they are elongated and more closely packed; their distance apart at the apex is usually about 0.2 mm.

FAMILY PORITIDÆ.

PORITES LICHEN, *Dana*.

Porites lichen, Dana, Zoophytes, U.S. Explor. Exped., p. 566, pl. lvi., fig. 2.

One small example, 3 cm. long, 2 cm. broad, and 5 mm. thick, with a reflexed margin. The calices are very variable in size, ranging from 1.5 to 2.5 mm. in diameter; in some cases the separating walls are indistinct, and several calices are included in a somewhat meandering valley as in *Nanopora irregularis*, Quelch.

PORITES LUTEA, *Edwards & Haime*.

Porites lutea, Edwards & Haime, Hist. Nat. Corall., iii., p. 180; Klunzinger, Die Korall. Rothen. Meeres, p. 40, pl. v., fig. 16.

A single specimen of this species is in the collection.

The corallum is 8 cm. high, and about 10 cm. in diameter. The calices are shallow, polygonal, with thin acute walls; they are about 1 mm. in diameter. The septa are thin and in two cycles; pali distinct, usually six; columella reduced to a single spiniform granule. In a few large corallites there are as many as twelve pali, and an incomplete third cycle of septa.

PORITES LOBATA, *Dana*.

Porites lobata, Dana, Zoophytes, U.S. Explor. Exped., p. 502, pl. lv., fig. 1.

A fine example of this species was obtained.

The corallum forms a broad semi-circular band around a dead block of coral, and measures 22 cm. in diameter, 8 cm. in width, and 12 cm. in height.

The surface is studded with numerous round or elongate gibbites, the smaller are about 1.5 cm. in diameter, the larger about 4 cm.; they vary in height from 1 to 3.5 cm. The depressions between are well defined angular grooves, generally running transversely across the band-like corallum. The calices are polygonal, shallow, almost flat, and about 1.5 mm. in diameter. The walls are distinct, a little raised, but thin and acute. Septa twelve, very thin; pali six, very prominent, as high as the walls and frequently joined at the base, forming a conspicuous ring round the columella, which is usually represented by a solitary spiniform granule.

The surface echinulæ consist of short bluntish spines, bearing a number of ill-defined granules.

PORITES CRASSA, Quelch.

Porites crassa, Quelch, Chall. Rep., Zool., xvi., p. 183, pl. xi., fig. 2-2a.

A small incrusting example of this species is in the collection.

PORITES MIRABILIS, Quelch.

Porites mirabilis, Quelch, Chall. Rep., Zool., p. 185, pl. xi., fig. 5-5a.

There are three specimens of this rare species in the collection. Of these, two are small, irregularly-convex, and incrusting; about 5 cm in diameter and 2 cm. high. The third and much larger specimen forms a subglobose mass with several basal expansions; the surface is somewhat uneven and gibbous.

PORITES GAIMARDI, Edwards & Haime.

Porites gaimardi, Edwards & Haime, Hist. Nat. Corall., iii., p. 179.

There are two specimens referable to this species. The smaller is subglobose, 5.5 cm. in height and 6.5 cm. in diameter. The larger is 19 cm. long, 14.5 cm. broad, and 12 cm. high. When seen in profile the shape suggests a human cranium from which the facial portion has been removed. The surface is even, save some superficial depressions which are present in great numbers, but can only be observed when the specimen is held up towards the light.

The calicles resemble those of *Porites astræoides*, Lamarck, they are, however, smaller, and the walls are not so stout; their diameter is usually about 1.1 mm., rarely more but frequently less. The walls are subsolid at the base, and somewhat acute at the summit.

The septa are in two cycles, thin, and somewhat ill-defined; the interseptal spaces are either circular, elongate, or keyhole shaped. There are six pali, which are usually remote from the centre of the calyx. Columella wide at the top, but rarely with more than one granule.

SYNARÆA UNDULATA, Klunzinger.

Synaræa undulata, Klunzinger, Die Korall. Rothen. Meeres, p. 48, pl. vi., fig. 12, pl. v., fig. 30.

One specimen obtained on the reefs in the lagoon.

The example is incrusting, and measures 6 cm. in length, 4 cm. in width, and from 2 to 3 mm. in thickness.

The surface and characters generally closely agree with Klunzinger's figures and description.

THE HYDROZOA, SCYPHOZOA, ACTINOZOA,
AND VERMES OF FUNAFUTI.

By THOMAS WHITELEGGE.

ERRATA.

- Page 389, par. 3, first line—*add after* “fig. 2,” “and Plate xxvii.,
fig. 1.”
- „ „ par. 4, third line—*for* “fig. 6,” *read* “fig. 2.”
- „ „ par. 4, last line—*for* “fig. 7,” *read* “fig. 1.”
- „ 390, par. 3, second line—*for* “fig. 8,” *read* “Plate xxvii.,
fig. 2.”
- „ „ par. 3, last line—*delete* “fig. 8.”
- „ 392, par. 2, fourth line—*for* “perceptable,” *read* “perceptible.”
- „ 398, par. 2, fourth line—*for* “indicate,” *read* “indicates.”
- „ „ par. 4, fourth line—*for* “have,” *read* “has.”
- „ 399, par. 2, fourth line—*for* “reject,” *read* “rejects.”
- „ 400, par. 1, thirteenth line—*for* “*I. collaris*,” *read* “*T. collaris*.”

Numerous local examples, both living and preserved, have been utilized with a view to render their identification less difficult in the future. In order to accomplish this, the pneumatophore was carefully measured, the colour noted, and the number of appendages counted. The results of an examination of thirty-four specimens are given in tabular form, from which it will be seen that the two forms are very distinct.

The class *Scyphozoa* is represented by two species—*Aurelia clausa*, Lesson; and *Phyllorhiza orithyia*, Haeckel.

Of *Actinozoa* there are six species in the collection, three of which are herein described as new, one belonging to the order



THE HYDROZOA, SCYPHOZOA, ACTINOZOA, AND VERMES OF FUNAFUTI.

BY THOMAS WHITELEGGE,
Zoologist, Australian Museum.

THE collection has provided material for much work, and the results obtained are of considerable interest; they may be summarised as follows:—There are only two *Hydroid Zoophytes* in the collection, both of which prove to be new species, *i.e.*, *Thuiaria divergens* and *Plumularia clavícula*. The latter is of unusual interest, inasmuch as it exhibits characters of rare occurrence in the group. The apices of the branches are modified into tendrils, and the corbulæ are of a very primitive type, having a slightly modified hydrotheca at the base of each costa.

The *Hydrocorallines* are represented by four species of *Millepores*:—*Millepora squarrosa*, var. *incrassata*, Dana; *M. platyphylla*, Ehr.; *M. nodosa*, Esper.; and *M. tortuosa*, Dana.

Of the order *Siphonophora*, there is only one representative, *i.e.*, *Physalia megalista*, Lamk., of which there are numerous examples. These have been carefully examined and compared with local material and also with specimens of *Physalia utriculus*, Eschscholtz.

Attention is called to the occurrence of secondary tentacles in the basal groups of cormidia in both species; a character which has hitherto escaped observation. The specimens from Funafuti and numerous local examples, both living and preserved, have been utilized with a view to render their identification less difficult in the future. In order to accomplish this, the pneumatophore was carefully measured, the colour noted, and the number of appendages counted. The results of an examination of thirty-four specimens are given in tabular form, from which it will be seen that the two forms are very distinct.

The class *Scyphozoa* is represented by two species—*Aurelia clausa*, Lesson; and *Phyllorhiza orithyia*, Haeckel.

Of *Actinozoa* there are six species in the collection, three of which are herein described as new, one belonging to the order

Antipatharia (*Antipathella brooki*), and two to the order *Actinaria* (*Zoanthus funafutiensis*, and *Gemmaria willeyi*). The remaining three are *Palythoa howesii*, Hadd. & Shack.; *P. kochii*, Hadd. & Shack.; and *P. coesia*, Dana.

The *Actinaria* have been worked out in conjunction with Mr. J. P. Hill, of the Sydney University, who kindly cut the sections and examined the internal structure; he is, therefore, jointly with myself, responsible for this portion of the publication.

The *Vermes* are represented by three species of *Polychæta*, two species of *Perichæta*, and five species of *Gephyrea*. They are as follows:—*Eurythoe complanata*, Pallas; *E. pacifica*, var. *levukænsis*, McIntosh; *Phyllodoce*, sp.; *Perichæta grubei*, Rosa, *P. sp.*; *Phymosoma nigrescens*, Keferst; *P. scoleps*, Sel. & de Mann; *Aspidosiphon elegans*, Cham. & Eysenn.; *A. steenstrupii*, Diesing; and *Cleosiphon aspergillum*, Quartref.

CLASS HYDROZOA.

Order HYDROMEDUSÆ.

FAMILY SERTULARIDÆ.

THUIARIA DIVERGENS, sp. nov.

(Plate xxiii., figs. 1, 2, 3.)

Trophosome: Hydrocaulus simple, indistinctly and irregularly jointed, strongly fascicled below, becoming monosiphonic distally; height from 5 to 6 cm. Hydrothecæ alternate, one opposite the base of each pinna, and two on the same side, one of which is situated in the axil above and the other about 0.2 mm. below. The base of each of the cauline hydrothecæ possesses a thick chitinous process which extends across the internal cavity of the stem and becomes united with the opposite wall.

Pinnae alternate, from 1 to 2 cm. in length and about 2 mm. apart; joints transverse, very irregular; one or two pairs of hydrothecæ to an internode, frequently two or more internodes without hydrothecæ on each pinna.

Hydrothecæ 0.7 mm. in height, 0.3 mm. in broadest diameter, diminishing to 0.2 at the apex; proximally they are opposite, distally they become subalternate, they are adnate for about one-third or one-half of their height, but not in contact with each other at the back; the free portion is abruptly bent outwards; the outline above is horizontal or slightly ascending, and evenly curved below; the terminal third exhibits numerous lines of growth. Aperture operculate, subquadrate, with four angles, one pair in a line with the axis, the other lateral.

Gonosome: Gonangia ovate, borne on the front of a pinna at the base of a hydrotheca 1·7 mm. high, 0·5 mm. broad in the middle, and 0·3 mm. at the neck, which is about as high as broad, surface with from 8 to 10 distinct annulations. Aperture square with four membraneous opercular teeth.

FAMILY PLUMULARIDÆ.

AGLAOPHENIA CLAVICULA, sp. nov.

(Plate xxiii, figs. 4, 5, 6.)

Trophosome: Hydrocaulus simple, monosiphonic, attaining to 3 cm. in height, the terminal 1·3 cm., consists of an undulate tubular extension indistinguishable from similar tubular growths which constitute the hydrorhiza. Hydrocladia alternate, one to each internode, arising from the front of the stem, from 2·5 to 7 mm. in length, and about 0·5 mm. apart. Hydrothecæ closely approximate, 0·25 mm. in height and about 0·14 mm. in diameter. The shape is urceolate with a slight constriction below the base of the teeth. Margin with seven erect teeth, the median one is evenly rounded at the apex, those at the sides are somewhat acute.

Intrathecal ridge distinct, extending transversely across the basal portion of the hydrotheca.

Lateral nematophores 0·1 mm. in length, 0·05 mm. in diameter, slightly projecting beyond the margin of the hydrotheca; aperture elongate, opening upwards and inwards.

Mesial nematophore 0·2 mm. in length, 0·05 mm. in its broadest diameter, adnate to the hydrotheca to within 0·1 mm. of the summit of the central tooth. Hydrothecal internode with a short ridge or fold opposite the basal constriction of the hydrotheca.

Gonosome: Corbula closed, 2·5 to 3 mm. in length, and 1·1 mm. in diameter; the first internode bears a normal hydrotheca. There are from 8 to 12 pairs of adnate costæ; each costa bears from 6 to 8 minute nematophores along its upper margin, and has a modified hydrotheca at its base. In a median longitudinal line on the upper surface are situated a series of from 8 to 10 elliptic or elongate apertures with broad, flat, thickened margins, similar to those figured by Allman in the *Challenger* Report.*

These species exhibit two characters which are of great interest from a morphological point of view.

In the first place the apical portion of the stem is destitute of the usual appendages; at a short distance above the terminal pinnules the nodes are also suppressed, and the stem becomes a

* Allman—"Challenger" Report—Zool., vii., pl. xx., fig. 6.

simple tubular tendril, which entwines itself around other stems or foreign objects, and thus affords the colony an additional means of attachment.

The corbula is of the closed kind, and consists of a modified branch bearing an alternating series of short stumpy branchlets, each of which carries a hydrotheca differing from those on the ordinary pinnules in being longer, more cylindrical, and in having nine instead of seven marginal teeth.

The distal branches of the corbulæ exhibit the mode of origin of the costæ and costal appendages from the mesial nematophore of the hydrotheca. The specimens at my command are very few, and their extreme transparency renders the outlines of the costal membranes difficult to trace. Three stages, however, can be distinctly discerned. In the earliest stage the mesial nematophore is seen projecting from the front and arising from the base of the hydrotheca, it assumes a fan-shaped outline, and consists of a wide membrane with an incipient micro-nematophore at its inner distal angle; in the next phase the membrane is larger and there is one fully formed micro-nematophore and another incomplete one at the inner extremity; on the next older costa there are three fully formed micro-nematophores, and the membranous part is proportionately enlarged.

Prof. Allman, in his report on the Hydroida of the Gulf Stream,* describes two species—*A. distans* and *A. bispinosa*—in which there are modified hydrotheca at the base of each costa; both, however, are of the open corbulæ type, and the hydrothecæ appear to be more modified than in the species under notice.

CLASS HYDROZOA.

Sub-Order HYDROCORALLINÆ.

FAMILY MILLEPORIDÆ.

MILLEPORA SQUARROSA, Lam.

Millepora squarrosa, Lam., var. *incrassata*, Dana, U.S. Explor. Exped., Zoophytes, pl. liii., fig. 1; Synop. Rep. Zooph., 1859, p. 105.

A single example of this species is in the collection.

The specimen consists of a subtriangular plate 12·5 cm. in height, 18 cm. in width, from 1 to 1·5 cm. in thickness near the base, and from 1·5 to 2·3 cm. at the summit. The upper semi-circular margin is much thickened, lobate and roundly truncate; at one extremity there are two toe-like lobes 5 cm. high, 3·3 cm. broad, 1·3 cm.

* Mem. Mus. Comp. Zool., v., 2, pp. 44-46.

thick at their origin and 2 cm. at their apex, their outer lateral margins are thick, their inner ones thin and acute. The rest of the upper margin consists of one broad lobe with three shallow indentations. The general surface is uneven, having a few low round or ridge-like elevations, and numerous shallow depressions in which the very regular cyclosystems are situated.

The gastropores are absent from the thick apical ridge, elsewhere they are very evenly distributed; they are on an average about 2 mm. apart and 0.25 in diameter. The dactylopores are generally confined to a limited area around the gastropores; they vary in number from four to six, their diameter is about 0.12 mm. and their distance from the central pore between 0.2 and 0.4 mm.

The surface is minutely porous and reticulately ridged; the ridges are pretty regular, about 0.05 mm. apart.

MILLEPORA PLATYPHYLLA, *Ehrenberg*.

Millepora platyphylla, (Ehrenberg) Dana, U.S. Explor. Exped., Zoophytes, p. 548, pl. lii., fig. 5.

A small fragment from the upper portion of a colony is in the collection.

The piece consists of three or four flat lamellæ, two of which have grown out vertically and at right angles to the main frond. The lamellæ are from 1 to 2 cm. in thickness, the apical margin is somewhat thin and rounded, the lateral margins are acute.

The surface is slightly tuberculous; the tubercles are low, rounded and longitudinally arranged.

Pores very unequally distributed, not distinctly arranged in systems. Gastropores irregularly scattered, 0.2 mm. in diameter. Dactylopores usually about 0.1 mm. in diameter, unevenly distributed over the whole colony. Surface reticulation with very minute ridges, usually under 0.05 mm. apart.

MILLEPORA NODOSA, *Esper*.

Millepora nodosa, Esper, Die Pflanzenthier, pl. ix.; Moseley, Chall. Rep. Zool., ii., p. 18, pl. xiii., fig. 3.

There are several fine examples referable to this species; of these three are well marked forms differing considerably in habit, but very similar in the cyclosystems and in the minute structure of the surface.

Form A.—The finest example possesses a large incrusting base inclosing a mass of dead material of the same species. From the upper surface there arises a series of irregular flattened lobes and

branches; the summits are usually obliquely truncated, and either acute or evenly rounded. The larger branches bear from two to three lobe-like branchlets similar to those figured by Moseley in the "Challenger" Report.*

The specimen measures 17 cm. by 8 cm. at the base; the main branches are from 3 to 6 cm. wide at their origin, and from 1.2 to 2 cm. in their shorter diameter.

Form B.—The specimen consists of a compressed branched frond 19.5 cm. high, 7 cm. wide at the base, and 1.7 cm. in thickness. At a distance of 8 cm. from the base there arise two main branches; each gives off a few flat lobes at the sides and terminates in three or four subpalmate lobes.

Form C.—Consists of an antler-like reticulate frond, with widely divaricate and frequently coalescent branches; they are either alternate or opposite, and subdichotomous, especially near the summits. The terminal branchlets are a little compressed in the plane of branching; the rest, including the basal portions, vary from oval to subquadrate in transverse section, and measure from 1 to 2 cm. in diameter.

Another specimen is intermediate in habit between forms *B* and *C*.

The general surface in all the examples is characterised by numerous small elevations upon which the pore systems are situated; this is especially marked on the younger parts of the corallum, elsewhere they are not so conspicuous.

The gastropores are usually about 0.28 mm. in diameter, and from 1 to 2 mm. apart, they are somewhat crowded, but rather irregularly distributed. The dactylopores are about 0.18 mm. in diameter, they are very numerous and not distinctly arranged in cycles except on the younger parts of the colony.

The surface reticulation is rather coarse as compared with other species; the ridges are on an average fully 0.1 mm. apart.

MILLEPORA TORTUOSA, Dana.

Millepora tortuosa, Dana, U.S. Explor. Exped., Zoophytes, pl. lii., figs. 3–3a.; Synop. Rep. Zoophytes, p. 105.

This species is represented by a single specimen, closely resembling Dana's figure. The main branches are, however, a little broader, varying from 5 to 12 mm. in width. The whole surface of the branches is covered with very fine slight elevations upon which the pore systems are situated. The gastropores are very

* Moseley—"Challenger" Report—Zool., ii., pl. xiii., fig. 3.

evenly distributed; they are generally under 2 mm. apart and about 0.2 mm. in diameter. The dactylopores are about 0.1 mm. in diameter, and pretty regularly arranged in cycles.

The surface ridges are about 0.1 mm. apart.

Order SIPHONOPHORA.

FAMILY PHYSALIDÆ.

PHYSALIA MEGALISTA, Lamk.

Physalia megalista, Lamk., Anim. sans Vert., ii., 1816, p. 481; Peron et Lesueur, Voy. de Découvertes aux terres australes, Atlas, 1807, pl. xx., fig. 1; Haeckel, Chall. Rep. Zool., xviii., pp. 351–372.

Numerous examples of this species were obtained by Mr. Hedley, who also made a coloured sketch from a living specimen; the colours exhibited in the drawing, and by the specimens when received, agree with examples of this species from the coast of New South Wales.

During the past five or six years I have paid special attention to the *Physalidæ* occurring on our coast; two species have been observed, i.e., *Physalia megalista* and *P. utriculus*.* They occur nearly all the year round with favourable winds, such as N.E., E., or S.E., occasionally in company, but more frequently only one species is obtainable at a time. I have at various times closely examined hundreds of living individuals of both species, and can readily separate the two by their colour alone. There are, however, other more important characters which clearly indicate that they are specifically distinct.

In *Physalia megalista* the crest is long in proportion to the rest of the pneumatophore, whilst the anterior crestless portion is remarkably short. The ventral group of cormidia are arranged in well defined clusters, two anterior and three posterior to the main tentacle. Each cormidium consists of a short broad pedicel—more or less transverse to the axis—and a series of short branchlets from which arise the ventral appendages: siphons, tentacles, palpons, and gonodendria.

The basal group of cormidia are separated from the ventral by a very short space. They consist of five or six clusters of small palpons, siphons, and frequently from one to three tentacles in addition to that which subtends the terminal proto-siphon.

* Chun unites all the Pacific and Indian Ocean forms under the name of *Physalia utriculus*. (See Zool. Anzeig., x., 1887, p. 558.)

The presence of accessory tentacles in the basal group of cormidia, appears to have hitherto been overlooked in the genus *Physalia*.

Prof. E. Haeckel, in the "Challenger" Report,* remarks that "The smaller basal group, at the posterior or distal end of the trunk, produces merely a series of small siphons and palpons, placed before the protosiphon and is provided with a single tentacle only; it always remains sterile and never produces gonophores." And again, on page 344: "The primary tentacle which belongs to the protosiphon, remains either as the single tentacle of the basal cormidium, or it is afterwards lost; but I have never seen secondary tentacles developed in this distal group."

From the above remarks it seems clear that the secondary tentacles occurring in the basal group of cormidia have escaped notice. This may be due to imperfect or ill-preserved specimens from which some of the species have been described.

In living or well-preserved examples of either *Physalia utriculus* or *P. megalista*, the basal tentacles are very conspicuous and may be easily seen by the unaided eye. In badly preserved specimens, in which the tentacles are generally more or less contracted, they are not so evident; they can, however, be readily distinguished with a hand lens of moderate power.

With a view of rendering it less difficult to separate the two Pacific species, I have carefully dissected and measured a series of specimens of each. The results are embodied in the accompanying tables.

In dissecting the specimens, I began by isolating the anterior cormidia, and afterwards snipping off the entire bunch of appendages without rupturing the pneumatophore. The siphons, tentacles, and gonodendria were then separated and counted. The palpons have not been taken into account.

In the first twelve enumerated in the table, the siphons of the basal groups have not been noted. In the last six, the whole of the cormidial appendages—palpons excepted—both ventral and basal have been enumerated. The gonodendria were counted according to age; thus, in some cases, as many as four occur in one cormidia, all being in a different state of development. In the larger examples of *P. utriculus*, it often proved difficult to determine whether the last (sixth) ventral cormidium should be regarded as one cluster or two; frequently there is a clear space on each side, indicating two pedicels, but the dividing line is not continued through the centre.

* Haeckel—"Challenger" Report—Zool. xviii., p. 341.

P. MEGALISTA (FROM FUNAFUTI).

	Ventral cormidia						Basal cormidia.						Total Ventral cormidia	Total Basal cormidia
	1st	2nd	3rd	4th	5th	6th	1st	2nd	3rd	4th	5th	6th		
Length of specimen, 25 mm													25 mm	
Number of siphons	8	7	...	5	7	9	...	...	...	...	...	...	36	...
„ tentacles	3	3	1	3	3	3	1	...	...	...	...	1	16	2
„ gonodendria ...	1	1	...	1	1	...	...	...	...	...	...	...	4	...
Length of specimen, 30 mm													30 mm	
Number of siphons	14	12	...	12	10	18	...	...	...	...	...	...	66	...
„ tentacles	5	3	1	5	4	3	0	...	...	...	...	1	21	1
„ gonodendria ...	1	1	...	1	...	...	...	...	...	...	...	...	3	...
Length of specimen, 35 mm													35 mm	
Number of siphons	8	6	...	3	8	10	...	...	...	...	...	...	35	...
„ tentacles	3	1	1	1	4	3	1	...	...	...	...	1	13	2
„ gonodendria ...	1	1	...	1	...	...	...	...	...	...	...	...	3	...
Length of specimen, 40 mm													40 mm	
Number of siphons	10	10	...	8	8	14	...	...	...	...	...	...	50	...
„ tentacles	4	3	1	3	1	4	0	...	...	...	...	1	16	1
„ gonodendria ...	...	...	...	...	...	...	...	...	...	...	...	...	0	...
Length of specimen, 40 mm													40 mm	
Number of siphons	9	6	...	7	7	10	...	...	...	...	...	...	39	...
„ tentacles	3	3	1	2	3	3	1	...	...	...	...	1	15	2
„ gonodendria ...	1	1	...	1	...	...	...	...	...	...	...	...	3	...
Length of specimen, 55 mm													55 mm	
Number of siphons	17	19	...	14	12	16	...	...	...	...	...	...	78	...
„ tentacles	5	7	1	5	5	6	3	...	...	...	...	1	29	4
„ gonodendria ...	...	...	...	1	1	...	...	...	...	...	...	...	2	...

P. MEGALISTA (FROM MAROUBRA, NEW SOUTH WALES).

													Total Ventral cormidia	Total Basal cormidia
	1st	2nd	3rd	4th	5th	6th	1st	2nd	3rd	4th	5th	6th		
Length of specimen, 45 mm													45 mm	
Number of siphons	11	7	...	10	9	12	...	...	...	...	...	...	47	...
„ tentacles	3	4	1	5	5	3	1	...	...	...	...	1	21	2
„ gonodendria ...	1	1	...	1	1	...	...	...	...	...	...	...	4	...
Length of specimen, 50 mm													50 mm	
Number of siphons	15	9	...	12	14	17	...	...	...	...	...	...	67	...
„ tentacles	5	7	1	5	6	5	3	...	...	...	...	1	29	4
„ gonodendria ...	1	2	...	2	...	...	...	...	...	...	...	...	5	...
Length of specimen, 55 mm													55 mm	
Number of siphons	20	12	...	14	12	18	...	...	...	...	...	...	76	...
„ tentacles	8	5	1	4	3	7	1	...	...	...	...	1	28	2
„ gonodendria ...	3	2	...	2	1	1	...	...	...	...	...	...	9	...

P. MEGALISTA (FROM MAROUBRA, NEW SOUTH WALES)—*continued.*

	Ventral cormidia						Basal cormidia.						Total Ventral cormidia	Total Basal cormidia
	1st	2nd	3rd	4th	5th	6th	1st	2nd	3rd	4th	5th	6th		
Length of specimen, 60 mm													60 mm	
Number of siphons	12	12	...	12	10	25	...	...	...	...	...	...	71	...
" tentacles	5	8	1	5	5	5	2	...	...	...	...	1	29	3
" gonodendria ...	1	1	...	1	2	1	...	...	...	...	...	...	6	...
Length of specimen, 65 mm													65 mm	
Number of siphons	18	12	...	12	10	12	...	...	...	...	...	...	64	...
" tentacles	7	8	1	8	6	4	2	...	...	...	...	1	34	3
" gonodendria ...	1	2	...	1	1	1	...	...	...	...	...	...	6	...
Length of specimen, 70 mm													70 mm	
Number of siphons	15	12	...	16	12	20	...	...	...	...	...	...	75	...
" tentacles	7	9	1	7	7	7	0	...	...	...	...	1	38	1
" gonodendria ...	1	1	...	2	1	3	...	...	...	...	...	...	8	...

P. UTRICULUS (FROM MAROUBRA, NEW SOUTH WALES).

Length of specimen, 50 mm													50 mm	
Number of siphons	20	22	...	26	28	40	4	2	1	0	0	1	136	8
" tentacles	6	5	1	6	5	10	3	3	1	0	0	1	38	8
" gonodendria ...	2	2	...	3	3	1	...	...	...	...	...	...	11	...
Length of specimen, 50 mm													50 mm	
Number of siphons	18	21	...	25	34	54	4	2	1	0	0	1	152	10
" tentacles	7	7	1	5	8	14	3	2	2	2	0	1	42	10
" gonodendria ...	2	2	...	2	1	2	...	...	...	...	...	...	9	...
Length of specimen, 55 mm													55 mm	
Number of siphons	26	34	...	30	34	40	5	2	1	0	0	1	164	9
" tentacles	7	5	1	5	6	8	3	2	0	0	0	1	32	6
" gonodendria ...	1	3	...	2	1	...	...	...	...	...	...	...	7	...
Length of specimen, 60 mm													60 mm	
Number of siphons	24	28	...	23	32	40	5	3	1	0	0	1	147	10
" tentacles	7	10	1	6	6	13	3	2	1	0	0	1	43	7
" gonodendria ...	1	2	...	2	2	...	...	...	...	...	...	...	7	...
Length of specimen, 70 mm													70 mm	
Number of siphons	26	28	...	28	24	48	4	3	2	0	0	1	154	10
" tentacles	7	7	1	8	7	10	4	2	2	0	0	1	40	9
" gonodendria ...	1	2	...	2	2	1	...	...	...	...	...	...	8	...
Length of specimen, 120 mm													120 mm	
Number of siphons	54	50	...	60	51	87	19	10	12	5	0	1	302	47
" tentacles	15	14	1	15	10	27	7	5	5	4	0	1	82	22
" gonodendria ...	4	3	...	4	3	6	...	...	...	...	...	...	20	...

The foregoing table, although not exhaustive, exhibits a wide difference between the two species, especially in the number of ventral siphons and the secondary tentacles of the basal cormidia.

In *Physalia megalista* the lowest number of siphons is 35, the highest 78; in *P. utriculus* the lowest is 136, the highest 302, or, leaving out the large specimen, 164. The secondary basal tentacles in the former vary from 1 to 4, and in the latter from 6 to 22.

There are other important characters, which exhibit a number of differences in the length, colour, or distance of one part from another; some of these, although varying slightly in themselves within certain limits, are pretty constant in each species, and are very evident when the two species are compared. They may be enumerated as follows:—

P. megalista.

Crest of pneumatophore	...	...	...	long
Apical crestless portion	...	...	...	short
Distance between ventral and basal cormidia	...	...	...	short
Length occupied by basal group of cormidia	...	...	...	long
Apex of pneumatophore	...	...	...	green
Summit of crest	...	...	...	magenta
Mouths of siphons	...	...	...	yellow

P. utriculus.

Crest of pneumatophore	...	...	...	short
Apical crestless portion	...	...	...	long
Distance between ventral and basal cormidia	...	...	...	long
Length occupied by basal group of cormidia	...	...	...	short
Apex of pneumatophore	..	...	...	blue
Summit of crest	...	...	...	Campanula blue
Mouths of siphons	...	...	...	white

With a view of testing the pneumatophore to see if it would yield any reliable specific character, I have carefully measured a series of living, dead, and preserved specimens. I am well aware that the pneumatophore is a very variable structure; but, as in most other organisms, when at ease or in a restful condition, it has a certain definite form which may be regarded as the shape of the living object when in a healthy normal state. In the following measurements—as far as the material would allow—specimens have been selected that came nearest to what I regard as the natural shape of the pneumatophore.

	<i>P. megalista</i> From Maroubra.				<i>P. megalista</i> From Funafuti.				<i>P. utriculus</i> . From living specimens.				<i>P. utriculus</i> . Fresh dead specimens				Large specimen preserved in formol.
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
Number of specimen ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Length of specimen ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	120
Number of primary chambers in crest ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7
Length of crest ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	80
" anterior crestless portion ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	49
Distance from anterior end of crest to main tentacle ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	61
Distance from anterior end of crest to protosiphon ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	85
Distance from posterior end of crest to main tentacle ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	37
Distance from posterior end of crest to protosiphon ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	36
Distance from main tentacle to protosiphon	29	35	31	33	25	35	30	34	25	32	41	24	21	35	50		51
Distance between ventral and basal groups of cormidia ...	6	7	9	5	4	7	6	5	19	32	18	10	11	11	14		20
Length occupied by basal group of cormidia	16	17	19	15	9	19	16	15	12	16	22	10	10	11	17		15

In the above measurements, certain factors must be taken into consideration. In living specimens stranded on the beach, or examples kept for some time in confinement, the anterior crestless portion of the pneumatophore is usually shorter than in healthy floating individuals. In very sick, dead, or dried examples, it generally attains to its normal proportions.

The posterior and ventral lobes usually contract a little under any circumstances, and are often much shorter in dried or preserved specimens than in life.

With a little care it is possible to preserve the pneumatophore in its natural shape. Specimens that are uninjured, and floating on the sea, may be caught in a wide-mouthed bottle, or placed in a vessel with a small quantity of sea-water. After a short time they generally assume a restful or normal condition. A 10 per cent. solution of formol will fix them without any perceptible change taking place. When fixation is completed, sufficient sea-water should be added to reduce the mixture to about one or two per cent., in which fluid they may be kept for years without much loss of form or colour.

The pneumatophore may also be dried with little or no alteration. I have succeeded in drying many specimens that have retained their natural form. My method of procedure is as follows:—The specimen is floated into a wide-mouthed bottle; when it has assumed its normal condition, it is plunged into the hot dry sand on the beach; then, as quickly as possible, the pneumatophore is rubbed with dry sand until all the surface moisture is absorbed; the appendages are then removed, and the specimen left in the sun; when thoroughly dry it is placed in fresh water to extract the salt, and afterwards again dried and placed in an air-tight bottle. Specimens dried in this manner have retained their shape for several years and exhibit no signs of deterioration except in colour.

CLASS SCYPHOZOA.

Order DISCOMEDUSÆ.

FAMILY AURELIDÆ.

AURELIA CLAUSA, Lesson.

Aurelia clausa, Lesson, Voy. de la Coquille, Zool., p. 119.

Four specimens of this species, were obtained in the lagoon.

FAMILY POLYRHIZIDÆ.

POLYRHIZA ORITHYIA, Haeckel.

Polyrhiza orithyia, Haeckel, System der Medusen, p. 578.

Orithyia incolor, Quoy & Gaimard, Voy. de l'Astrolabe, iv., p. 297, pl. xxv., figs. 6–10.

One example, found stranded on the beach. The specimen is not in a good condition, and is doubtfully referred to this species.

CLASS ACTINOZOA.

Subclass ZOANTHARIA.

Order ANTIPATHARIA.

FAMILY ANTIPATHIDÆ.

ANTIPATHELLA BROOKII, sp. nov.

The corallum is erect, pinnate and branched in a single plain; it is 8 cm. in height and 6.5 cm. broad; the stem (?) at the base is 1 mm. in diameter.

The specimen consists of two main fronds, having the shorter branches fused here and there at the base but free at the summits. Each frond gives off a series of alternate—rarely opposite—pinnules. The primaries arise almost at right angles, and are slightly curved upwards at a short distance from their origin. The secondaries also are at right angles to their support; they are generally straight, simple, or with numerous short branchlets, occasionally a few are elongate and slightly curved.

The primary pinnules are from 2 to 3 cm. in length, and pretty regularly 4.3 mm. apart; the secondaries are from 5 to 15 mm. in length and 3 mm. apart; the tertiary pinnules vary from 1 to 7 mm. in length.

The polyps on the pinnules are situated on the anterior surface, forming a single longitudinal series; there are six to 1 cm.; they are about 1.1 mm. in length, and are separated from each other by short intervals varying from 0.2 to 0.4 mm.

The polyps do not commence at the bases of the branchlets; there is generally a nude space—from 0.4 to 0.6 mm. in length—at their point of origin from the stem. The latter also usually has a similar polyp-less space above and below the base of a branchlet. On the stouter portions of the corallum a few of the polyps are radiate or subradiate, elsewhere they are elongate. There are two distal and two proximal tentacles situated in a line with the pinnule, and two placed transversely—one on each side of the mouth—which are generally smaller and inserted on the sides of the pinnule, not on the anterior surface as is the case with the other two pairs. The tentacles are about 0.25 mm. in length. The oral prominence is slightly elongate transversely, it is 0.1 mm. in height, 0.5 mm. in its longer and 0.35 mm. in its shorter diameter. The mouth is a narrow, elongate, slit-like opening, with

an irregular crenated margin. The zooids are not sufficiently well preserved to afford accurate internal structural details.

The spines near the apices of the pinnules are short and somewhat triangular; below they are elongate and subcylindrical, with smooth, acute, abruptly tapering summits. They are arranged in longitudinal rows and frequently exhibit a spiral arrangement running from right to left; five rows may be seen from one aspect, four of which are included in the spiral arrangement. Many of the spines on the stouter pinnules are given off at right angles, generally they are slightly inclined upwards, their length is about 0.3 mm., and measured from apex to apex in a spiral 0.4 mm. apart.

This species is allied to *A. tristis* and *A. atlantica*.

SUB-CLASS ZOANTHARIA.

By J. P. HILL, B.Sc., F.L.S., AND T. WHITELEGGE.

FAMILY ZOANTHIDÆ.

ZOANTHUS FUNAFUTIENSIS, sp. nov.

(Plate xxiv., figs. 2, 3).

Form.—Body-wall smooth, translucent, surface transversely wrinkled when contracted. Cœnenchyme thin, encrusting, continuous or becoming stoloniferous at the margin. Column short, often broader than high. Capitulum slightly expanded, with from 45 to 50 ridges, confined to the upper swollen surface. Oral cone a little prominent, aperture longer than broad. Tentacles 24 to 28, similar, arranged in two cycles.

Colour.—The specimens were preserved in formol, and when received were of a bright grass green. The colour has now faded entirely, and the colony is greyish with slight tinge of olive.

Dimensions of colony 8.5 by 4.7 cm.; height of an average-sized polyp 5 mm., diameter of the capitulum 5 mm., of the column 3 mm.

ANATOMY.

Body-wall (Plate xxv., fig. 1).—The body-wall is bounded externally by a cuticle to which stray diatoms and sponge spicules are found adherent. Between the cuticle and the ectoderm is a thin peripheral layer of mesoglœa, consisting of fine anastomosing strands, and having a thickness of .003 mm. The ectoderm is a thin continuous layer in which cell outlines are not recognisable. It is crossed here and there by fine strands from the mesoglœa, which unite to form the peripheral layer as described by Haddon and Shackleton in *Z. coppingeri*.*

* Reports on the Zoological Collections made in Torres Straits: Actinidæ, i. Zoanthæ—Sci. Trans. R. Dublin Soc. (2), iv., xiii., p. 677.

In the ectoderm there are present narrow oval nematocysts, 0.14 mm. long, but zooxanthellæ are absent. Slightly branched canals arising from the ectoderm are present in the mesoglaea, but are not at all numerous, though somewhat more abundant in the lower part of the column. In the rarity of ectodermal canals the species under consideration agrees with *Z. jukesii*, H. & S., and as in that species lacunæ are fairly numerous. Small cell-groups and isolated rounded or spindle-shaped cells, produced into radially running processes, also occur in the mesoglaea. Nematocysts are present in the ectodermal canals in small numbers. In the lacunæ there occur very definite, small, rounded or oval bodies, often in considerable numbers. In general appearance these resemble nematocysts, but are apparently quite homogeneous internally and show no trace of threads.

The entoderm is thin, and contains nematocysts and numerous zooxanthellæ. The entodermal circular musculature is weakly developed, and supported by minute mesoglaeal plaitings.

Capitulum.—The ectoderm here is ridged and thicker than that of the column-wall. It contains nematocysts.

Sphincter muscle.—The double mesoglaeal sphincter muscle is well developed. Its upper portion is about three times the length of the lower. The latter consists of a single row of cavities, rounded in shape and larger than those of the upper portion which are small and compressed and not arranged in a single row. In both, the muscle fibres are supported on plaitings of the mesoglaea.

Tentacles.—The ectoderm is thick and is crowded with enormous numbers of small sausage-shaped nematocysts, 0.1 mm. in length. zooxanthellæ are absent. The ectodermal musculature, longitudinal in direction, is moderately strong and supported on small plaitings. The mesoglaea is thin, and contains only small scattered cells. The entoderm is a very thick layer. It contains numerous nematocysts similar to those of the ectoderm, and zooxanthellæ are also numerous. The circular entodermal musculature is very weak.

Disc.—The ectoderm of the disc is ridged. It is in general similar to the ectoderm of the tentacles, but nematocysts are here not so numerous. The mesoglaea contains isolated cells and cell-groups. In the entoderm numerous zooxanthellæ are present. The musculature of the disc is weak.

Esophagus (Plate xxv., fig. 2).—The ectoderm is thrown into distinct longitudinal folds. The groove is wide and well marked. The ectoderm contains nematocysts, and here and there in the basal parts of the cells there occur groups of refractive yellow (pigment?) granules. The mesoglaea forms a uniformly thin layer. The entoderm is also thin, and contains zooxanthellæ in no great

numbers. The ectodermal musculature, longitudinal in direction, and the entodermal, circular in direction, are both weakly developed.

Mesenteries (Plate xxv., fig. 2).—The mesenteries are slender, and have the normal brachyneremic arrangement. The reflected ectoderm of the œsophagus forms ridges (8 – 11 in number) along the two faces of each perfect mesentery, and is limited to the inner half of the radial extent of each mesentery. Below, the peripheral folds of the reflected ectoderm are continued on as the mesenterial filaments. These are at first V-shaped in section, but lower down the free limbs of the V soon disappear, and the ectoderm of the filament assumes a rounded bulbous form. At the same time the entoderm becomes thickened immediately below the filament, giving rise to a second bulb-like swelling. The ectoderm of the filament contains numbers of deeply-staining gland-cells, and in its deeper part occur numerous small granules which stain slightly with eosin. Rod-shaped nematocysts also occur in the ectoderm, as well as in the thickened entoderm. The mesenterial filaments continue to near the base of the column, and are considerably folded. The mesogloea of the mesenteries is a thin layer, which, however, becomes somewhat thickened just before joining the body-wall. In this outer thickened part is situated the single basal canal of the mesentery. In the lower part of the column, the mesogloea of the mesenteries is somewhat thicker and the basal canals are larger. The entoderm of the mesenteries is a thin layer containing zooxanthellæ, which are usually much more numerous on one face of the mesentery than on the other. Nematocysts are sparingly present in the entoderm. The parieto-basilar muscles are supported on mesogloéal plaitings, and are well developed. The longitudinal musculature is fairly well developed, and supported on small plaitings.

Gonads.—Gonads were not present in any of the specimens examined by us.

This species is closely related to *Z. jukesii*, H. & S., but is to be easily distinguished by, among other points:—(1) its smaller size, (2) its green coloration, (3) the absence of nematocysts from the entoderm of the tentacles.

GEMMARIA WILLEYI, sp. nov.

(Plate xxiv., figs. 1 and 4).

Form.—Body-wall opaque, encrusted with foreign matter and minutely granular. Surface even when extended, transversely wrinkled when contracted. Cœnenchyme incrusting, forming broad expansions or band-like stolons. Column often slightly swollen in the middle. The capitular region greatly expanded, with about forty very short radial ridges. Disc large, radiately ridged. Oral cone prominent, aperture oblong. Tentacles short, subequal, eighty in number, arranged in two cycles.

Colour.—As per coloured sketch, drawn by Mr. C. Hedley on the spot. Column pale green, capitulum pinkish, disc pale violet, tentacles brownish-orange; in formol, yellowish-grey.

Dimensions.—Length of largest colony, 7 cm.; breadth, 5 cm. Length of largest polyp, 1·7 cm.; diameter at base, 5 mm.; in the middle, 7 mm.; at the capitulum, 11 mm.; diameter of disc about 8 mm.; oral aperture, 3 mm. by 1·5 mm. Length of tentacles about 1·8 mm.; contracted examples are usually somewhat flattened at the summit—varying from 6 to 10 mm. in diameter—and frequently broader at the summit than long.

ANATOMY.

Body-wall (Plate xxvi., fig. 1).—The ectoderm is thick, measuring in breadth ·07 mm., and forms a definitely continuous layer. It is provided externally with a thin cuticle, to which occasional diatoms adhere. A peripheral layer of mesogloea is absent. Numerous incrustations consisting of grains of calcareous sand, foraminiferal shells etc., are present in the ectoderm and peripheral portion of the mesogloea, forming a layer about ·15 mm. thick. Owing to the presence of these incrustations, the ectoderm appears in decalcified sections considerably broken up, and is here and there separated by a space, extending over a considerable area, from the underlying mesogloea. The ectoderm contains zooxanthellae in considerable numbers and also numbers of large nematocysts. One of the largest of the latter observed measured 1·35 mm. in length by ·06 mm. in breadth, but their average size is considerably less than this.

As is characteristic of the genus, ectodermal canals are absent from the mesogloea. Large rounded or oval lacunae are, however, abundant in the outer two-thirds of the layer. The lacunae contain large nematocysts (usually one in each), similar to those of the ectoderm and also contain numbers of zooxanthellae. Besides lacunae small cell-islets and isolated cells produced into very distinct radial processes are present in the mesogloea. Except in its most peripheral portion, below the ectoderm, the mesogloea is almost completely devoid of incrustations. Occasional siliceous spicules however do occur.

The entoderm of the body-wall is thickened between the mesenteries and contains zooxanthellae but they are here not so numerous as in the ectoderm. The circular entodermal musculature is well developed.

Capitulum.—The outer surface of the capitulum is ridged, the ridges alternating with the tentacles of the outer cycle. The ectoderm is thicker than that of the column and is not so densely crowded with incrustations. These are here more abundant in the outer part of the mesogloea.

Sphincter Muscle.—The single mesogloæal sphincter muscle is well developed (Plate xxvii., fig. 1, *m.s.*). The muscle cavities are large and arranged in an irregular alternating fashion.

Tentacles.—The ectoderm of the tentacles is crowded with small slightly curved nematocysts (.010 mm. long), among which occur occasional large ones. Zooxanthellæ are also very numerous. The longitudinal ectodermal musculature is strongly developed and supported on close-set plaitings of the mesogloæ. The mesogloæa is of moderate thickness and contains only small isolated cells. The entoderm is thin. It contains numerous zooxanthellæ but no nematocysts. The circular entodermal musculature is moderately strong.

Disc (Plate xxvi., fig. 2).—The disc is traversed by ridges which pass one from the base of each tentacle of the inner and outer rows to the margin of the mouth. In the ridges both ectoderm and mesogloæa are somewhat thickened. The ectoderm especially on the ridges contains nematocysts similar to those in the tentacles and also zooxanthellæ. In the deeper portion of the ectoderm there occur numbers of small bright refractive (pigment?) granules. The ectoderm is devoid of incrustations.

The mesogloæa of the disc is thick, and especially noteworthy from the presence in it of numerous large ectodermal muscle cells (fig. 6, *ect. m.*) These project into the mesogloæa so obliquely that in sections they mostly appear as isolated masses which occupy the upper two-thirds of the mesogloæa, and extend from the margin of the mouth across the horizontal part of the disc and for a short distance up in its vertical part (fig. 7).

McMurrich, and Haddon and Shackleton, also describe enclosures in the disc mesogloæa of the species of *Gemma* examined by them. In *G. isolata*, McMurrich* describes the mesogloæa of the disc as being "densely loaded with enclosed cavities containing cells probably ectodermal and muscular," but in his later description of *G. rusei*, D. & M., he says,† "the enclosures in the mesogloæa of the disc which I thought might possibly be muscle cells in *isolata*, are seen in *Rusei* to be comparable to the lacunæ of the column wall." Again Haddon and Shackleton in their description of *G. macmurrichi* (page 689), remark that "cell enclosures (similar to those described and figured by McMurrich) are found in the disc of *G. macmurrichi*," and they also mention the occurrence of such in *G. mutuki*. May it not be that in all these cases we have to do as in the species under description with ectodermal muscle cells, and may not the existence of such in the mesogloæa of the disc be a character diagnostic of the genus?

* The Actiniaria of the Bahama Islands.—*Jour. of Morphology*, iii. p. 64.

† A contribution to the Actinology of the Bermudas.—*Proc. Acad. Nat. Sci. Phil.*, 1889, p. 125.

The entoderm of the disc is thin and contains zooxanthellæ. The entodermal musculature is weak.

Esophagus.—The groove (Plate xxvii., fig. 2 *gr.*) is well marked and has in one specimen examined by us, the same truncated form described by McMurrich in *G. isolata*, and Haddon & Shackleton in *G. mutuki*. The ectoderm contains large and small nematocysts and a few zooxanthellæ are also present. In the basal part of the ectoderm colourless refractive granules as well as groups of yellowish-brown granules are present. The mesogloea is considerably thickened below the groove.

Mesenteries.—The mesenteries are typically brachycnemic in arrangement (fig. 8), but in one specimen examined the sulcar mesentery of the second pair on one side was perfect, thus realising the macrocnemic condition. The mesogloea of the mesenteries is on the whole thin but is somewhat thicker in the basal part of the column. Peripherally also the mesogloea in each perfect mesentery is thickened where it encloses the basal canal and again becomes constricted before joining the body wall. The imperfect mesenteries are short and bulbous and project little into the cœlenteron (fig. 8).

Each mesentery encloses a main basal canal appearing in section narrow and elongated in the perfect and rounded in the imperfect mesenteries. In the mesogloea internally to the basal canals in the perfect mesenteries there occur small lacunæ. In the basal canals there are present large nematocysts similar to those in the lacunæ of the body-wall, and zooxanthellæ also occur in the canals and lacunæ, but in no great numbers. The basal canals run up into the region of the disc where they divide into several smaller canals.

The entoderm is a thin layer in which zooxanthellæ are fairly abundant, especially in the œsophageal region.

Occasional nematocysts are also present. The parieto-basilar muscles are supported on platings of the mesogloea and are well developed. The longitudinal musculature is weak.

The reflected ectoderm on the two sides of each perfect mesentery give rise to numerous (up to 20) close set ridges of which the inner and outer project freely. Below, the peripheral free portions pass into the mesenterial filaments in the usual fashion. The filaments have at first in section the shape of an arrow-head, but soon the free margins disappear and the central part remains as a bulbous thickening below which the entoderm is also enlarged. Here, just as in *Z. funafutiensis*, the inner margin of the mesentery has the shape in section of a double bulb. In the ectoderm of the filament there are present occasional zooxanthellæ and large nematocysts, while gland cells are very numerous. A few large

nematocysts also occur in the thickened entoderm, and zooxanthellæ are here more numerous than in the ectoderm of the filament. The filaments are convoluted below and terminate some distance from the base of the column.

Gonads.—In one of the specimens examined by us ovaries were found as small whitish swellings disposed in irregular longitudinal rows along especially the lower portions of the mesenteries, in the region of the mesenteric filaments.

In *G. mutuki*, Haddon and Shackleton record finding ripe sperm cells in the celenteron of one individual.

We have much pleasure in associating this well marked species with the name of our friend Dr. A. Willey, in appreciation of his untiring labours in the South Seas.

PALYTHOA HOWESII, Haddon and Shackleton.

Palythoa howesii, Haddon and Shackleton, Sci. Trans. R. Dublin Soc. (2), iv., 1891, p. 693, pl. lxi., fig. 13; pl. lxiii., fig. 8.

A single example is here referred to this species. Several specimens from Thursday Island are in the Museum collection, with which the Funafuti example has been compared and found to agree in all the external characters.

The specimen consists of an oblong colony 9 cm. long, 3 cm. wide and 1.4 cm. high, the basal cœnenchyme forms a projecting margin all round the colony, from 2 to 5 mm. wide, and from 1 to 3 mm. in thickness. The polyps are about 7 mm. in diameter. The capitular ridges number about 28 or 30.

PALYTHOA KOCHII, Haddon and Shackleton.

Palythoa kochii, Haddon and Shackleton, Sci. Trans. R. Dublin Soc. (2), iv., 1891, p. 694, pl. lxi., fig. 12; pl. lxiii., fig. 9.

A small specimen agreeing in its general characters with examples of this form from Thursday Island. It is a thin incrusting colony 6 cm. long, 3.5 cm. wide and having a pretty uniform thickness of 7 mm. The capitular ridges are very variable in number from 15 to 20. The polyps are however much contracted and the ridges more or less indistinct.

PALYTHOA CÆSIA, Dana.

Palythoa cæsia, Dana, U.S. Explor. Exped., Zooph., p. 40, pl. xxx., fig. 3, 3a to 3h; Haddon and Shackleton, Sci. Trans. R. Dublin Soc. (11), iv., 1891, p. 695, pl. lxi., fig. 14.

Two specimens both more or less biconvex in shape. The larger example is 3.6 cm. in diameter and 3 cm. in height. Polyps about 15 mm. high and 9 mm. in diameter. The upper surface and tentacles are of a bright reddish maroon colour. The specimens are in formol.

Class CHÆTOPODA.

By T. WHITELEGGE.

Order POLYCHÆTA.

Family AMPHINOMIDÆ.

EURYTHOE COMPLANATA, *Pallas.*

Eurythoe complanata (Pallas), Baird, Jour. Linn. Soc., Zool., x., 1870, p. 222.

A single specimen is here referred to this species. The example is 25 cm. in length, 2 cm. in width, and 1.2 cm. in thickness; there are 135 body segments. The head is too much retracted to determine the limits of the caruncle without injuring the specimen. The body is pretty uniform in width to within 2 or 3 cm. of the extremities.

The dorsal bristles consist of three forms, there are numerous elongate tapering bristles a few of which are simple, the majority however are subbifid, the shorter division being rudimentary and scarcely perceptible, the longer division is much elongated tapering and smooth. There are also numerous stout, broad serrated bristles having from 40 to 50 strong recurved teeth. The ventral bristles are stout with broad bifid and compressed apices, the longer divisions are quite smooth and about seven or eight times longer than the shorter, frequently there are one or two slender bifid bristles in which the divisions are long and cylindrical.

EURYTHOE PACIFICA, var. LEVUKENSIS, *McIntosh.*

Eurythoe pacifica var. *levukensis*, McIntosh, Chall. Report, Zool., xii. p. 29, pl. xvi., fig. 5; pl. 11a fig. 14; pl. 111a figs. 10-12.

There are numerous specimens referable to this species, the body is tapering, measuring from 1.5 to 5 cm. in length and consists of about 60 segments. The bristles agree very closely with the figures given by McIntosh in the Challenger Report.

Family PHYLLODOCIDÆ.

PHYLLODOCE sp.

This form is represented by several specimens and is closely allied to if not identical with *P. quadraticeps*, Grube; it agrees in every character except the number of bristles. Grube's species is said to have but five, whereas the Funafuti examples have six.

There are five worm tubes in the collection similar in shape and structure to those inhabited by *Eunice tibiana*, Pourt., but I failed to find any worms in them.

Order OLIGOCHÆTA.

Family PERICHÆTIDÆ.

PERICHÆTA GRUBEI, *Rosa.*

Perichæta Grubei, Rosa, Ann. d. K.K. Naturhist. Hofmus., vi. 1891, p. 395, pl. xiii., fig. 4a, 4b.

Two specimens appear to belong to this species, they are not in a good state of preservation and it is impossible to make out some of the specific characters.

PERICHÆTA SP.

There are two specimens of another species of *Perichæta* probably introduced into the island. The only perfect example is 7.5 cm. in length, the segments are one hundred in number, the / shaped setae are 0.2 mm. in length, and number about 50 per segment. The dorsal and anterior spermathecal pores if present are very small, I failed to find them with a lens. The clitellum occupies the fourteenth, fifteenth, and sixteenth segments, the female pore is situated in a line with the setae on segment fourteen. The male pores occur on the eighteenth segment, they are transversely elongate and papillose, each pore is about 1 mm. in length, and the distance between their inner margins is about the same. The median ventral line bears eight papillae, there is one on each segment from fifteenth to twenty-first, the twenty-second being without; the remaining two are on segments twenty-three and twenty-four.

The dorsal surface is purplish-brown with green iridescent reflections, sides and under surface lighter.

Class GEPHYREA.

Order SIPUNCULOIDEA.

Family SIPUNCULIDÆ.

PHYSCOSOMA NIGRESCENS, *Keferstein*.

Physcosoma nigrescens (Keferstein), Selenka, in Semper's Reisen. Arch. der Philippinen, iv., Die Sipunculiden, p. 72, pl. ix., figs. 130 – 136.

There are two examples of this well marked species, both are well preserved and fully extended. In the larger specimen the body is 2 cm. in length, and the proboscis is about 2.2 cm.

PHYSCOSOMA SCOLOPS, *Selenka and De Mann*.

Physcosoma scolops, Selenka, Semper's Reisen. Arch. der Philippinen, iv., Die Sipunculiden, p. 75, pl. ii., fig. 17; pl. x., figs. 138 – 144.

Three examples of this species are in the collection. The largest example is 3 cm. in length, the large chitinous papillæ and the intense colour markings serve to readily distinguish this form.

ASPIDOSIPHON ELEGANS, *Cham. and Eysenh.*

Aspidosiphon elegans (Cham. and Eysenh.), Selenka, Semper's Reisen. Arch. der Philippinen, iv., Die Sipunculiden, p. 124, pl. i., figs. 10, 10a; pl. xiv., figs. 124 – 208.

One specimen, the body measures 3.5 cm., the proboscis is wholly retracted.

ASPIDOSIPHON STEENSTRUPII, Diesing.

Aspidosiphon steenstrupii (Diesing), Selenka, Semper's Reisen. Arch. der Philippinen iv., Die Sipunculiden, p. 116, pl. i., figs. 12, 13; pl. xiii. figs. 190 - 192.

A single specimen is here doubtfully referred to this species. The body and proboscis are of a uniform pale brown colour, the anterior and posterior shields are darker, the latter is granular and radiately grooved, the former is slightly granular; an encircling series of about twenty small tubercles mark the line of union of the proboscis with the body.

The proboscis is clothed with a series of chitinous bodies of two kinds, those on the anterior half consist of flat curved bidentate hooks arranged in rings, each hook is about 0.05 mm. in height and 0.04 in width at the base. On the posterior half the chitinous bodies are scattered, they are elongate, three sided, slightly bent but not hooked at the summits, they are 0.04 mm. in height and 0.025 in width at the base. Numerous papillate skin glands occur between the rows of hooks, one to every four or five hooks.

The retractor muscles are 15 mm. in length, they are attached about 3 mm. from the posterior end of the body and are joined together at about 4 mm. from their point of attachment. The segmental organs are equal in length to the combined portion of the retractors, and are free from the body-wall for three fourths of their length. At the posterior third of the body there are twenty-five longitudinal muscle bands.

This form comes very near to *A. speculator*, Selenka, but the retractors are united much nearer the posterior end of the body, and the segmental organs are free for a greater distance than in Selenka's species.

CLOEOSIPHON ASPERGILLUM, Quatrefages.

Cloeosiphon aspergillum (Quatrefages), Selenka, Semper's Reisen. Arch. der Philippinen iv., Die Sipunculiden, p. 126, pl. ii. figs. 23, 24; pl. xiv. figs. 214 - 216.

A solitary example is somewhat doubtfully referred to this species. The specimen is 6 cm. in length, the proboscis is damaged and no hooks were available for examination. In other respects it agrees fairly well with the published description.

THE MOLLUSCA OF FUNAFUTI.

Part I.—Gasteropoda.

By CHARLES HEDLEY.

[XVII.]

THE MOLLUSCA.

Part I. — Gasteropoda.

By CHARLES HEDLEY.

Many of the introductory remarks which prefaced collections previously dealt with, apply with equal force to the Mollusca. Little was known of the Mollusca of the Ellice Group prior to our Expedition. With one exception, none of the naturalists—Dana, Whitmee, Woodford, Finsch—who have been to the archipelago, gathered any shells. The exception being Dr. Ed. Graeffe, who visited most of the atolls in the interest of the Godeffroy Museum. The land shells he procured are described by Mousson.* A few other animals described by German authors from this group were probably also collected by him.

The poverty of the fauna of the atoll, compared with that of any continental area lying under corresponding latitudes, such as Queensland, New Guinea, or the Melanesian Plateau, again asserts itself. Whole groups, the Brachiopoda and the Polyplacophora, are missing, giving to the fauna an unsymmetrical aspect. Especially significant is the absence of Mollusca with large eggs such as *Nautilus*, *Melo*, or *Voluta* from this drifted fauna. In many cases the Funafuti shells are smaller than the usual stature of their respective species. Harper Pease has remarked that the marine Gasteropoda of the Paumotu are in general dwarfed in comparison with those of Tahiti.† Shipley mentions that specimens of Gephyrean worms from Funafuti were considerably smaller than representatives of the same species from Rotuma.‡

Poor though this fauna be, I have to apologise for the following inadequate account of it. Thorough search would probably result in multiplying the known total three or four times. My commission embraced the study of the Atoll as a whole. Although the Mollusca alone would have afforded occupation for the entire time of an investigator, yet Ethnology, and Botany, and other branches of Zoology equally claimed my attention. On my return the mass of material, molluscan and otherwise, together with the

* Mousson—Journ. de Conch. xxi. 1873, pp. 102 – 109.

† Pease—Am. Journ. Conch. iv. 1868, p. 109.

‡ Shipley—Proc. Zool. Soc. 1898, p. 468.

pressure of current Museum duties has operated unfavourably on my report. Various inquiries on anatomy and other related matters have been perforce omitted. With the exception of a sketch of the geographical distribution I have unwillingly restricted myself to the mere systematic treatment of the species.

A superficial reader might seize on the fact that many new species are described as new in the following pages, and with a show of reason deduce that so great a proportion of novelties indicate a very peculiar and endemic fauna. This would however be a mistaken impression. Few realise how exceeding rich the fauna of the tropical Pacific is, or how poor our knowledge thereof. Probably, except in New Caledonia, a capable collector would obtain at least one shell new to science in a day's work on any beach in the South Pacific. Fischer's estimate that the Indo-Pacific Province contains five or six thousand marine mollusca,* is certainly below the mark.

For the purpose of comparison the Funafuti fauna must be divided into large conspicuous, and small inconspicuous shells. The distribution already ascertained for conspicuous genera like *Cypraea* will be paralleled, as knowledge increases, for inconspicuous genera like *Caecum*. Thus I anticipate the discovery in the western continental islands of every minute species I have described as new from Funafuti. The range of all the species mentioned is given for the South Pacific as completely as opportunity permitted. A discussion of the data collected is postponed to the concluding pages of this Memoir.

The study of the mollusca of the Pacific is attended with peculiar difficulty. As a result of the superior energy of the British in exploration, commerce and missionary enterprise in the Pacific, the vast majority of the mollusca of this region have, from the time of Captain Cook to the present day, been first examined in London. The writers who have dealt with them, Adams Bros., Hinds, Reeve, the Sowerbys, Smith, Melvill, and others, have treated them uniformly on the model and method of Lamarck; it will be convenient to call this group of authors the "London School." A brilliant exception to the work of British writers is the superb Memoir by Boog Watson on the Gasteropoda collected by the Challenger Expedition.

As a consequence of the devotion of the London School to the study of the Pacific fauna, we have a great mass of involved synonymy, inadequate descriptions, poor figures or none, crude classification and total neglect of soft anatomy. The smaller portion of this fauna which has gone to Paris has generally been well figured, and a fraction which has fallen into the hands of

* Fischer—*Man. de Conch.* 1887, p. 157.

American students has received scientific treatment. A higher grade of work was reached by a poor, solitary, invalid exile like Montrouzier than by men who had within their reach the unrivalled resources of the collections, the libraries and artists of London.

To descend from generalities to details, it may be pointed out that whilst the foremost British and American writers in all other branches of zoology now use English; whilst the scientific writers of other countries, like Sars and Collett in Norway, Schepman in Holland and various Japanese authors, are adopting English as an international language, on the grounds of its wide currency, wealth and flexibility; yet this conservative London school of Conchologists reject the advantages of their mother tongue and satisfy their humble wants with the poor and awkward medium of Latin.

By some strange unwritten law these Conchologists have invariably maintained a proportion between the size of a shell and its illustration. Thus a large shell, however simple in structure, demanded a large figure; and a small shell, however complex its details, a small drawing. Had this school encountered Pachyderms or Foraminifera, one or both would surely have fallen beyond the focus of their vision.

Though great wealth of anatomical material was proffered them, these writers have ever cast the "nasty things" aside. The fascinating studies of structure, affinities, higher classification, or geographical distribution had no charm for them. Their measure of excellence in Conchological research being apparently the highest score of new species.

But the chief defect of this school is that it has added to the superstructure without strengthening the foundation, and has thus weakened instead of improved the fabric of our knowledge. Upon the distinction of old species depends not only generic and sub-generic classification, but even the reality of new species, which are necessarily contrasted with them. The task of rehabilitating old species, for which these writers have unique facilities, is by them neglected in favour of the easier and more showy work of describing novelties, which could be done at least as well by others.

In illustration, I will cite the following case, one instance of a multitude. Hinds, in 1843,* thus described a new species, *Triforis collaris*:—"Testa ovata, acuminata; anfractibus duodecim biserialim granulosis, serie inferiorie paululum maxima, margaritacea, superiori pallide fusca; anfractu ultimo quadriseriatim subaequaliter concatenato. Axis 4 lin."

* Hinds—Proc. Zool. Soc., 1843, p. 23.

No one will to-day affirm that so brief an account suffices for the recognition of this species. Consequently there is every probability that it has been, or will be, again named and described to the confusion of science. In so numerous and difficult a group, a description a page long and several detailed figures are barely enough to determine a species in the absence of authentic specimens. It would be supposed that this view only required to be stated for every worker to endorse it, but for sixty-five years British writers have passed over this inadequate account and neglected to repair the fault. So recently as last year, Melvill and Standen in treating of the shells of Lifu, examined and catalogued this species, yet it never occurred to them that a figure and description was more urgently needed for *I. collaris* than for any of the hundred novelties they figured and described.

Great numbers of the species of Adams, Hinds, Smith and others are inadequately represented in literature, and cannot be recognised without an inspection of the type in London. Either therefore no Conchological work should be published except by residents of London, which is an absurd proposition, or these species must be ignored by naturalists.

The local conditions under which the Funafuti mollusca occur may be briefly sketched. The distinction between the marine and terrestrial mollusca, so sharply drawn in temperate zones, fades away in the tropics. At a distance from the sea, in close association with such forms as *Stenogyra* and *Endodonta*, occur *Littorina*, *Nerita*, *Truncatella* and *Melampus*. The outer windward beach, where the surf sweeps the narrow reef platform, is only accessible at intervals when a low tide coincides with calm weather. Here the molluscan assemblage bears the mark of incessant buffeting of waves, all are characterised by powerful muscular feet which adhere to the rock like the sucker foot of the limpet, all have thick shells mostly strengthened by knobs or ridges. In the little rock pools at the foot of the shingle beach, swarm the gaily painted shells of *Engina mendicaria*, *Mitra literata*, *Conus hebraeus* and *C. ceylonensis*. Beyond, where the surf breaks more heavily, are several species of *Sistrum*, usually nestled in a rock crevice and more or less concealed by extraneous growth upon their shells. Here also are *Purpura armigera* and *P. hippocastaneum*, and on the brink of deep water is *Turbo setosus*.

It comes as a surprise to a naturalist to find the pelagic fauna scarce in this latitude. Dr. Krämer tells me that he was greatly struck by the poverty of the tropical Pacific in this respect. One Pteropod, one Heteropod, and a fragment of *Ianthina* were all of this class that came under my notice.

The quiet waters of the lagoon prove a richer field for a collector than the storm swept ledges of the ocean beach. Just at the

south end of the main islet of Funafuti, where the lagoon communicates with the ocean, are some clumps of *Millepora* rising to the surface from about ten or twelve feet. On these is a colony of the giant *Vermetus*, and built in by coral growth are *Magilus* and *Galeropsis*. Near the *Millepora* were bushes of *Plexaura*, among whose branches perched *Avicula*. A sandy flat sheltered behind a long shingle bank yielded at low water *Mitra episcopalis*, *Murex ramosus* and *Trochus obeliscus*.

A mile to the north, where the quiet waters allowed mud to settle, the gregarious *Planaxis sulcatus* occurred in quantities. *Cypraea moneta* and *C. caput serpentis* were here abundant, and to the rocks in the neighbourhood adhered *Chama*. Nearer the village, at the spot sketched on p. 71, I found as dead shells most of the small species described as new.

A few small reefs in the lagoon opposite the village were excellent collecting grounds. The sandy patches among the coral were inhabited by *Strombus luhuanus* and *S. floridus*, and by numerous Cerithiidae, among which the large *C. nodulosum* was conspicuous. What seemed a brilliantly coloured worm disappeared at a touch with a snap and proved to be the animal of *Tridacna elongata* seen through the opening of the valves sunk in coral. Loose coral blocks rolled over and split up yielded a harvest; under the block might be *Conus rattus*, *C. lividus* or *Mitra limbifera*, and within it *Lithodomus* and *Arca*.

In a few hours spent on the leeward islets of the Atoll, I gathered on the beach several large but dead species of *Cypraea*, *Oliva* and *Conus*, which I had not elsewhere encountered. A glimpse of a rich and distinct deep water fauna was afforded by a few hauls of the tangles in 80–40 fathoms on the western outer slope of the Atoll. Almost everything here collected appears to be new to science.

The sole representative of a fluviatile fauna was a species of *Melania* which occurred in some abundance in the native wells.

Mr. George Sweet has kindly allowed me to inspect a collection of shells he made on Funafuti in 1897. I have been able in several cases to increase my list by species which he took, but which I had not seen.

CEPHALOPODA.

I was unable to secure any specimens of Cephalopoda at Funafuti, though I observed traces of them, as beaks thrown up on the beach and ink in the hands of the natives (p. 64). Pictures of an *Octopus* were recognized by the natives as "feki," and of a *Loligo* as "mofeki." I was told that on rare occasions empty *Nautilus*

shells drifted to the Atoll, but the natives positively asserted that they never occurred there alive. No shells of *Spirula* were seen on the beaches.

Dr. Georg Pfeffer has described* *Loligo brevipinnis* from the Ellice Group.

No members of the BRACHIOPODA or POLYPLACOPHERA were seen in the Ellice Islands.

SCAPHOPODA.

DENTALIUM LESSONI, *Deshayes*.

Pilsbry, Man. Conch. xvii., 1898, p. 8, pl. vi., figs. 36 – 90.

Two imperfect shells found on the sandy beach of the lagoon correspond more nearly to this than to any other described form.

GASTEROPODA.

HALIOTIS STOMATIAEFORMIS, *Reeve*.

Pilsbry, Man. Conch. xii., 1890, p. 89, pl. iii., fig. 4 ; pl. xlix., figs. 30 – 35.

I found a single dead shell on the windward side of Nukulailai. Mr. Sweet has sent me specimens from Funafuti.

Pilsbry records this from New Caledonia and Fiji.

EMARGINULA CLATHRATA, *Pease*.

Pilsbry, *op. cit.*, p. 266, pl. lxiii., fig. 12; Pease, Am. Journ. Conch. iv., 1868, p. 99, pl. ii., fig. 24.

Once found alive under a stone in the lagoon. Hitherto only known from Hawaii.

EMARGINULA MARIEI, *Crosse*.

Pilsbry, *op. cit.*, p. 271, pl. xxii., figs. 34, 35, 36.

A few bleached shells were gathered on the lagoon beach.

Hitherto only known from New Caledonia.

ACMAEA SACCHARINA, *Linne*.

Pilsbry, Man. Conch. xiii., 1891, p. 49, pl. xxxvi., figs. 60, 61, 62, 78 ; pl. xviii., figs. 31, 32 ; pl. xxiv., figs. 12, 13.

A few small and dead shells inclining towards the var. *perplexa*, Pilsbry, were found on the outer beach. Schmeltz mentions it from Queensland, Samoa, and Fiji.

* Pfeffer, Die Cephalopoden des Hamburger Naturhistorischen Museums.
—Abh. Geb. der Naturw. viii., 1884, p. 5, pl. i., fig. 4 ; pl. ii., fig. 4a.

PHENACOLEPAS SENTA, sp. nov.

(Fig. 1).



Fig. 1.

Shell cap shaped, with a protuberant and overhanging posterior apex, the earlier portion thin and translucent, the older solid and opaque; adult shell asymmetrical by reason of a slight spiral twist. Colour white. The nepionic shell is very smooth and glossy sharply contrasting with the dull surface of the remainder, depressedly turbinat, apparently two whorled but swallowed past the nucleus by the older shell. Sculpture:—on the part next the nepionic shell there are circular growth lines, as these diverge wider their interstices are crossed by longitudinal lines which develop later into low small rounded ribs parted by slight furrows, these are reticulated by two series of fine raised threads crossing at right angles. Upon these ribs arise in quincunx order a series of V-shaped thorns, the limbs of which are directed anteriorly. A portion of the dorsal surface immediately above the posterior base is selected in the accompanying figure for illustrating this feature. Finally the limbs increase till they meet those of their neighbours and enclose a rhomboidal space, thus the marginal part of the shell becomes cancellated by a raised network, oblique both to the line of growth, the axis of the shell and the earlier sculpture. The minute transverse thread lines persist to the aperture.

Aperture subcircular, the edge when adult is broadened and finely crenulated. Interior glossy, the exterior sculpture visible through the shell. Muscular impressions are a right and left adductor scar and a narrow horse shoe marking the head line a little within the lip. Length 6, breadth $4\frac{1}{2}$, height 3 mm.

Eight empty shells from sand on the beach of Funafuti lagoon.

This species has its nearest kin in *P. cinnamomea*, Gould, but differs so widely from that by contour, sculpture and exposed nepionic shell that a new genus seems necessary to express the distinction. Yet *P. cinnamomea* itself stands perhaps as far again from the type of the genus *P. crenulata*, Broderip, and being unable to offer any information on the animal of the new species, I am unwilling to further divide a group of which our knowledge is so brief.

Scutellina of Gray (1847) being preoccupied by *Scutellina* of Agassiz (1841), Pilsbry has substituted *Phenacolepas*.*

TROCHUS OBELISCUS, *Gmelin*.

Pilsbry, Man. Conch. xi., 1889, p. 19, pl. ii., figs. 13, 14.

Several specimens were taken alive in shallow water in the lagoon associated with *Mitra episcopalis*.

Fischer quotes this from New Caledonia, Fiji, Samoa and Tonga.

TROCHUS TUBIFERUS, *Kiener*.

Pilsbry, *op. cit.*, p. 31, pl. vi., figs. 62, 63.

Two living specimens were found at low water on the western side of the Funafuti lagoon.

Fischer† gives as the range of this species New Caledonia, Loyalty Islands, Upolu, Samoa, and Pilsbry adds Fiji.

TROCHUS ATROPURPUREUS, *Gould*.

Pilsbry, *op. cit.*, p. 77, pl. xi., figs. 28-32; pl. xiii., figs. 86, 87; pl. xv., figs. 50, 51.

Not uncommon as dead shells on the lagoon beach.

Pilsbry notes this from San Christoval, Solomons, Tutuila, Samoa and Fiji. In this Museum are specimens from New Caledonia and Tupuselei, Hood Lagoon and Milne Bay, British New Guinea.

TROCHUS FASTIGIATUS, *A. Adams*.

Reeve, Conch. Icon. xiii., 1861, Trochus, pl. xv., fig. 87.

Several dead specimens from the beach of the Funafuti lagoon. Though described nearly half a century ago, the locality of this species has not hitherto been announced. I have also collected it at Panie, New Caledonia.

GIBBULA CONCINNA, *Dunker*.

Pilsbry, *op. cit.*, p. 230, pl. xl., figs. 8, 9.

A shell plentiful at Funafuti and which I also saw at Nukulailai, seems, though not agreeing exactly, to be nearest this. The

* Pilsbry—The Nautilus, v., Dec. 1891, p. 88.

† Fischer—Coquilles Vivantes, Trochus, 1880, p. 117.

sculpture and, except for a white apex, the colour, is like that of *G. danieli*, Crosse, from which it differs by a crenulate umbilical margin. The largest is $7\frac{1}{2}$ mm in diameter and has an umbilicus $1\frac{1}{2}$ mm. broad.

G. concinna is known only from Upolu, Samoa.

GIBBULA PHASIANELLA, *Deshayes*.

Pilsbry, *op. cit.*, p. 235, pl. xxxi., figs. 31, 32, 33.

Dead shells frequently occurred on the lagoon beach of Funafuti.

Specimens from the Manchester Museum enable me to state that this is the species which Melvill and Standen record* from Lifu as "*Margarita striatula*, Phil.," a name which I have been unable to trace in literature. It has already been recorded from Lifu, and also from Ile Art by Fischer.† I found it alive in abundance under stones between tide marks, at Noumea, New Caledonia. It is represented in this Museum from Lord Howe Island.

The species hardly seems suitably placed in this genus.

MONILEA LIFUANA, *Fischer*.

Pilsbry, *op. cit.*, p. 252, pl. xli., figs. 6, 7; pl. lix., figs. 64, 65.

Commonly seen in a dead state on the sandy beach of the Funafuti lagoon.

As the name implies this species was first found at the Loyalty Islands. Smith‡ has recorded it from Torres Straits. It is also in this Museum from Aneiteum, New Hebrides.

MONILEA TRAGEMÀ, *Melvill & Standen*.

Melvill & Standen, *Journ. Conch.*, viii., 1896, p. 313, pl. xi., fig. 78.

A shell fairly plentiful in a dead state on the lagoon beach of Funafuti is referred here. The fifty examples before me show much variation. The colour ranges from pale pink articulated with white, through white irregularly splashed or microscopically dotted with pink, to entire chalky white. The elevation and angulation of the whorls vary, and the size of the largest (length $4\frac{1}{2}$ mm.) is almost double that of the type from Lifu.

EUCHELUS INSTRICUS, *Gould*.

Pilsbry, *op. cit.*, p. 441, pl. lxvii., figs. 62, 63.

A single dead specimen from the beach of the Funafuti lagoon.

* Melvill & Standen—*Journ. Conch.* viii., 1896, p. 126.

† Fischer, *op. cit.*, p. 364.

‡ Smith—*Zool. Coll. "Alert,"* 1884, p. 73.

Schmeltz quotes this from Fiji and Samoa. There are specimens in this Museum from New Caledonia.

TEINOSTOMA QUALUM, sp. nov.

(Fig. 2).

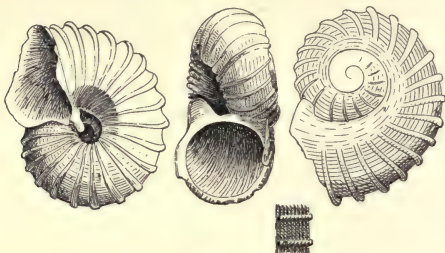


Fig. 2.

Shell with spire scarcely elevated, rather widely umbilicated. Colour white. Whorls three, flattened below the suture, rounded at the periphery and concave at the base. Sculpture:—the last whorl is ornamented by about twenty, broad, squarely projecting, transverse ribs, which arise at a distance from the suture, enlarge to the periphery and continue to the basal angle, these ribs vanish on the penultimate whorl; close, regular and fine, raised, spiral lines cover the whole shell, crossing the ribs and interstices alike; these are in their turn overridden by transverse microscopic threads. Base excavate in the centre. Umbilicus one-fifth of the shell's diameter, exhibiting the previous whorls. Aperture round, lip thickened, above spreading on the previous whorl and at the base projecting a callus tongue into the umbilicus. Major diameter 1·8; minor 1·4; height ·75.

Three specimens from sand on the lagoon shore, all of which are unfortunately broken at the aperture.

This closely resembles *Cyclostrema archeri*, Tryon* from Singapore, which is rather larger and more closely ribbed, but the basal callus on the lip of the present form has decided me in considering it generically and therefore specifically distinct from that.

TEINOSTOMA TRICARINATA, Melvill & Standen.

Melvill & Standen, Journ. Conch., viii, 1896, p. 311, pl. xi., figs. 75 a. b.

Three specimens occurred on the sandy beach of the Funafuti lagoon. The only other example known came from Lifu.

* Man. Conch. x., 1888, p. 89, pl. xxxiii., figs. 84, 85.

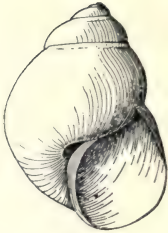


Fig. 3.

CIRSONELLA OVATA, sp. nov.

(Fig. 3).

Shell globose-ovate, thin, and semi-transparent, white, narrowly umbilicate. Whorls five, rounded, smooth, save for delicate growth-striations, margined and contracted below the suture. Aperture oblique, elliptical. Lip sharp, columella reflected. Length, $2\frac{1}{2}$, breadth 2 mm.

Three specimens from the lagoon beach.

LIOTIA CRENATA, Kiener.

Tryon, Man. Conch. x., 1888, p. 111, pl. xxxvi., figs. 12, 13.

One shell from the lagoon beach. This is represented in the Australian Museum from Aneiteum, New Hebrides. Smith quotes it from San Christoval, Solomons, and Melvill and Standen from Lifu.

PHASIANELLA WISEMANNI, Baird.

Pilsbry, Man. Conch. x., 1888, p. 181, pl. xxxix., figs. 73, 74.

Several specimens from the lagoon beach. Schmeltz unites with this *P. graffei*, Dunker.* Already recorded from the Ellice, Samoa, and Tonga, by Schmeltz. Reported by Pilsbry from Fiji and New Hebrides.

PHASIANELLA MINIMA, Melvill.

Melvill, Proc. Malac. Soc. ii., 1896, p. 115, pl. viii., fig. 11.

Three shells from the lagoon beach seem to be referable to this Bombay species.

STOMATELLA SANGUINEA, A. Adams.

Pilsbry, Man. Conch. xii., 1890, p. 18, pl. liii., figs. 85, 86.

Common as dead shells on the lagoon beach. Pilsbry notes this species from Fiji, Upolu, Samoa, and the Paumotu; Schmeltz adds Tahiti.

STOMATIA PHYMOTIS, Helbling.

Pilsbry, *op. cit.*, p. 31, pl. liv., figs. 16, 17, 21, 22.

Dead shells were not rare on the lagoon beach. Pilsbry records this species from Fiji, and Schmeltz from Upolu. In this Museum it is shown from New Caledonia and the Louisiades.

GENA ROSACEA, Pease.

Pilsbry, *op. cit.*, p. 41, pl. lv., fig. 12.

* Schmeltz—Museum Godeffroy, Cat. v., 1874, p. 145.

Several empty shells from the lagoon beach. Hitherto only recorded from the Paumotus.

TURBO PETHOLATUS, L., var. CALEDONICUS, Fischer.

Pilsbry, *Man. Conch.* x., 1888, p. 194, pl. xlv., fig. 99.

A few dead shells were collected on the beaches.

This variety, of a peculiar colour pattern, and angled more or less at the shoulder, is recorded by Fischer from New Caledonia, and Anaa, Paumotus. A specimen in this Museum from the Gilbert Islands shares this form and colour. Perhaps the typical form is replaced in the Central Pacific by this variety.

TURBO SETOSUS, Gmelin.

Pilsbry, *op. cit.*, p. 195, pl. lxiii., fig. 32.

Abundant on the east coast of the atoll at low water on the outer reef.

Fischer cites this species from New Caledonia, Tahiti, Paumotus, Marquesas, and Gilberts; Schmeltz adds Samoa. It is also shown in this Museum from the Solomons.

The opercula of the Funafuti examples agree with Fischer's description,* but not with Pilsbry's, being white and smooth, except on the distal margin, where they are brown and obliquely wrinkled.

TURBO ARGYROSTOMUS, Linne.

Pilsbry, *op. cit.*, p. 197, pl. xl., fig. 18; pl. xlii., fig. 41; pl. xlv., fig. 8.

This species was less abundant; it replaced the preceeding on the western side of the atoll. Fischer indicates it from Tonga, and from Anaa, Paumotus, and Schmeltz from Upolu. It is represented in this Museum from the Solomons, New Caledonia, Fanning Island, and Hawaii.

ASTRALIUM PETROSUM, Martyn.

Pilsbry, *op. cit.*, p. 234, pl. lxiv., figs. 65, 66.

I found this alive in the lagoon.

Pilsbry records this from New Caledonia, Fiji, and Hawaii. An example from Woodlark Island, British New Guinea, is in this Museum.

LEPTOTHYRA LAETA, Montrouzier.

Pilsbry, *op. cit.*, p. 258, pl. lxiii., figs. 29, 30.

Common on the lagoon beach at Funafuti.

Pilsbry records this from Australia, Solomons, Fiji, and New Caledonia.

* Fischer—Coquilles Vivantes, 1873, Turbo, p. 57.

DELPHINULA LACINIATA, Lamarck.

Pilsbry, *op. cit.*, p. 266, pl. lxxvii., figs. 1, 2, 4.

I collected a single worn shell on the sandbank in the centre of the Funafuti lagoon.

It is recorded by Kiener* from New Ireland, by Melvill and Standen† from the Loyalty, and there is a specimen in this Museum collected by Père Montrouzier at Woodlark Island, British New Guinea.

NERITOPSIS RADULA, Linne.

Tryon, *op. cit.*, p. 82, pl. xxix., fig. 68.

One dead shell was found on the beach.

Melvill and Standen record this from Lifu. Specimens from New Caledonia are described by Fischer.‡

NERITA ALBICILLA, Linne.

Martens, *Conch. Cab.* ii., 11, 1889, p. 25, pl. viii., figs. 1, 2.

One living example, found in the lagoon.

This species ranges south along the Australian coast to Sydney. Von Martens cites Port Carteret, New Ireland, Solomons, New Caledonia, Fiji, Samoa, Tonga, and Tahiti. A specimen from Erromanga, New Hebrides, is in this Museum.

NERITA MAXIMA, Chemnitz.

Martens, *op. cit.*, p. 29, pl. vi., figs. 1-5.

Two living shells from under stones between tides in the lagoon of Funafuti.

Von Martens quotes for this Jaluit, Marshalls, Fiji, Samoa, and Tahiti.

Specimens are in this Museum from Aneiteum, New Hebrides.

NERITA PLICATA, Linne.

Martens, *op. cit.*, p. 63, pl. x., figs. 6-10.

This species occurred at Funafuti in great profusion. The wave-worn breccia of the outer beach, just above high tide, is its favourite haunt. Here a hundred may be gathered from a few square feet. Into any crevice they crawl and huddle together like a cluster of *Helix aspersa* when hibernating. Their tenacity is wonderful. Often when picking them out of a crevice in the coral, I have pulled away the shell and found the foot and operculum adhering to the rock, torn from the viscera left in the

* Kiener—Coquilles Vivantes, 1873. *Delphinula*, p. 4.

† Melvill & Standen—*Op. cit.*, p. 126.

‡ Fischer—*Journ. de Conch.* xxiii., 1875, p. 197.

shell. This mollusc sometimes ascends the trunks of trees in the vicinity of the beach, and behaves more like a terrestrial than a marine organism.

Martens quotes the following habitats from the Pacific :—New Guinea, Tucopia, New Caledonia, Fiji, Upolu, Samoa, Uvea, Futuna, Tongatabu, Tahiti, Borabora, Gambier, Paumotus, Marquesas, Jaluit, Marshalls, Ponape, Guam, Carolines, and the Mariannes. Material in this Museum enables me to add Eromanga, New Hebrides, and the Solomons.

At Port Moresby, British New Guinea, I was told that this mollusc is locally called "mimi," meaning "to itch," because it made the tongue of the eater sore.

NERITA POLITA, Linne.

Martens, *op. cit.*, p. 72, pl. iii., figs. 5, 10–26; pl. xiv., figs. 1–18, 22–26.

One specimen of the typical form found alive in the lagoon of Funafuti.

Martens cites this from Queensland, New Ireland, Solomons, Fiji, Upolu, Samoa, Vavao, Tonga, Mangarewa, Society Islands, and Hawaii. I can add Eromanga, New Hebrides.

NERITA INSCULPTA, Recluz.

Martens, *op. cit.*, p. 88, pl. xi., figs. 1–4.

Two living specimens were found in the Funafuti lagoon.

Martens notices this from Upolu, Samoa, and Bowen, Queensland.

NERITINA RETICULATA, Sowerby.

Martens, *Conch. Cab.* ii., 10, 1879, p. 132, pl. xv., figs. 1–3.

Several dead shells were found on the beach of the Funafuti lagoon.

Martens cites this from Nukuhiva, Marquesas, Tahiti, Borabora, and Morutea. In this Museum it is reported from Strong Island, New Caledonia, and the Solomons.

HELICINA MUSIVA, var. ROTUNDATA, Mousson.

Mousson, *Journ. de Conch.*, xxi., 1873, p. 107.

Common at Funafuti. Graeffe collected this at Vaitupu.

EULIMA PYRAMIDALIS, A. Adams.

Tryon, *Man. Conch.*, viii., 1886, p. 270, pl. lxviii., fig. 14.

Three examples from the lagoon beach.

I cannot, from published data, separate the later described *E. solida*, Sowb., and *E. inflexa*, Pease. Granted this synonymy, the species extends to Fiji, Paumotu, and Hawaii.

EULIMA DECIPiens, sp. nov.

(Fig. 4).

Shell small, straight, rather broad, translucent, glossy. Colour porcelainous white. Apex mucronate. Whorls eleven, scarcely rounded, sculpture none. Suture scarcely perceptible; what first appears to be the suture, proves with further magnification to be the internal septa seen through the shell substance. Aperture pyriform, oblique, with a callous arched columella. Length 5, breadth $1\frac{1}{2}$ mm.

One living specimen from the lagoon.

This species somewhat resembles *E. piriformis*, Brugnone, than which it is rather narrower.



Fig. 4.

STYLIFER VARICIFERUS, sp. nov.

(Fig. 5).

Shell ovate conical, thin, translucent and shining. Apex broken but apparently acicular. Remaining whorls nine, of which the

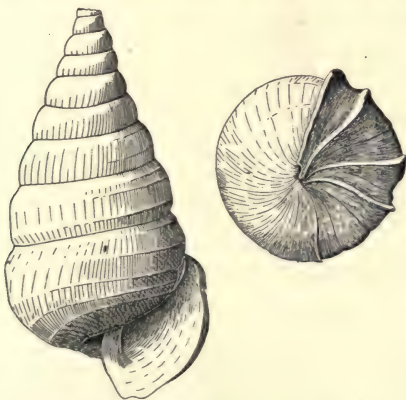


Fig. 5.

latter are markedly tumid and narrow, giving the shell a squeezed or telescoped aspect. The upper whorls are smooth and polished, the lower gradually acquire an oblique, longitudinal sculpture which becomes coarser as the shell proceeds and finally on the

last half whorl rise into sharp varices; on the latter three whorls several weak spiral threads reticulate the transverse growth lines and create angles below the suture and the periphery. Aperture very oblique, lip sharp, sinuous, reflected, effuse anteriorly, columella broad, arched, and reflected over a minute perforation. Length 11, breadth $6\frac{1}{2}$ mm.

This species in size and general shape approaches *S. eburneus*, Deshayes. But in the produced and effuse aperture it recedes from that towards *S. crotaphis*, Watson. A single specimen was produced at Funafuti.

ODOSTOMIA BULIMOIDES, *Souverbie*.

Tryon, *op. cit.*, p. 362, pl. lxxix., fig. 69.

Several specimens which appear to be the young of this species from the lagoon beach.

Described by Souverbie from New Caledonia and reported by Melvill and Standen from Lifu.

ODOSTOMIA RUBRA, *Pease*.

Tryon, *op. cit.*, p. 363, pl. lxxix., fig. 75.

One living example from the lagoon. Pease procured the type from the Paumotus.

PYRAMIDELLA DOLABRATA, var. TEREBELLOIDES, *A. Adams*.

Tryon, *op. cit.*, p. 300, pl. lxxii., fig. 74.

Two dead shells from the lagoon. There are specimens of this in the Museum from Hawaii, under the name of *Obeliscus sulcatus*, Nuttall.

PYRAMIDELLA TURRITA, *A. Adams*.

Tryon, *op. cit.*, p. 301, pl. lxxii., figs. 84, 85.

A few dead shell from the lagoon beach. Tryon records this from New Caledonia.

In these two latter species, aged or adult individuals develop pliae within the lip, a fact omitted in monographs.

PYRAMIDELLA MITRALIS, *A. Adams*.

Tryon, *op. cit.*, p. 305, pl. lxxiii., figs. 2, 3, 94, 97.

Two dead shells from the lagoon beach. Tryon quotes this from Tahiti; Melvill and Standen from Lifu. In this Museum it is represented from Guam, New Caledonia, and Lord Howe Island.

OBTORTIO, gen. nov.

A shell of the Turbonillidæ, small, conical. Apex of two minute discoidal whorls, half buried in a larger and longitudinally ribbed whorl, to which succeeds a ribbed and tabulate whorl; these

together constituting a mucronate tip. On the next whorl, which is also tabulate, the longitudinal sculpture almost disappears and spiral lyræ arise. Subsequently these latter are cancellated by a reappearance of the longitudinal ribs. Aperture oval with a broad and reflected columella, no varix.

Type *Rissoa pyrrhacme*, Melvill & Standen.

OBTORTIO PYRRHACME, *Melvill & Standen.*

Fig. 6.

Melvill & Standen, Journ. Conch., viii., 1896, p. 310, pl. xi., fig. 70.

These authors describe from Lifu, Loyalty Islands: "A pure white ochre tipped shell, whorls eight or nine, much swollen, longitudinally ribbed, spirally closely sulcate, aperture round, lip simple, a little effuse." This account is illustrated by a figure too small to give details of sculpture, aperture or apex. To identify a species from such data is a little hazardous, but the brown point to the white shell is a peculiar feature which leads me to see in "*Rissoa pyrrhacme*" a common New Caledonian shell, long known to the local collectors under the, doubtless erroneous, name of "*Fenella pupoides*, Adams."* I have collected this at Panie, New Caledonia, a day's sail from Lifu, whence Melvill and Standen derived *Rissoa pyrrhacme*.

Among shell sand on the lagoon beach of Funafuti I gathered a dozen specimens specifically inseparable from the Panie shells which I thus identified. They are smaller than Melvill and Standen's specimens, being barely four millimetres in length, whereas theirs are six, the tips, unlike my Panie examples, are faintly and barely touched with colour, as if singed by fire. In contour they exhibit much variety; two examples are drawn

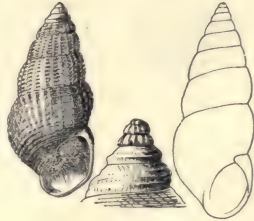


Fig. 6.

to the same scale to illustrate diversity of proportion, perhaps a sexual feature. The apex, which I hold to exhibit characters of generic importance, consists first of two very minute whorls which are almost buried in the succeeding whorl. These are very difficult to observe, being seen in two instances only in the series examined. A globose whorl, longitudinally ribbed, sometimes only obliquely wrinkled, commences the real spire. This, the subsequent whorl and the tip, together form an acicular point to the shell when viewed through a hand-lens. The second, third, and fourth whorls are tabulate, lending a pagoda aspect to the

* Cf. Schmeltz—Cat. Godeffroy Museum, v., 1874, p. 104.

upper spire. These are the whorls stained chestnut, so dark as to be almost black, in the New Caledonian specimens. The larger whorls are closely corded by spiral lyræ, having smaller lyræ in their interstices. Weak, longitudinal ribs undulate the central whorls and appear on the last whorl, but vanish there before reaching the periphery. The columella lip is broad and reflected, obliquely ridged within and sharply bent above. The aperture is perpendicular, ovate and grooved within.

Rissoa joviana of Melvill and Standen* appears to me to be an absolute synonym of *Alaba fulva*, Watson.† These and *Alaba striata*, Watson‡ should enter the same genus as *pyrrhacme*. Indeed I am not satisfied that all four names do not apply to aspects of one polymorphic species.



Fig. 7.

SCALA REVOLUTA, sp. nov.

(Fig. 7).

Shell minute; white, with smooth coiled apex and variced, solute, subsequent whorls. Whorls six, of which the apical three are smooth and in contact, the fourth commences to uncoil and the remainder are widely separate. Varices eight on the last whorl, with an anterior corner, slightly elevated; between the varices the shell is smooth and glossy. Aperture broken in the type example, but apparently circular. Length 3, breadth 1.5 mm.

One specimen from the lagoon beach.

The only shell for which the novelty might be mistaken is *S. hyalina*, Sowerby. Judging from Sowerby's drawing§ that differs by being much larger, broader, uncoiled to the tip, though less apart latterly, and by more numerous and serrate varices.

SCALA PAUMOTENSIS, Pease.

Tryon, Man. Conch. ix., 1887, p. 65, pl. xiii., fig. 16.

Four specimens from the lagoon beach. Cited by Tryon from Fiji, Gilberts, and Paumotus.

SCALA SUBAURICULATA, Sowerbie.

Tryon, *op. cit.*, p. 67, pl. xiv., figs. 21, 22.

Four specimens from the lagoon beach correspond fairly well with New Caledonian examples.

* *Op. cit.*, p. 309, pl. xi., fig. 69.

† Chall. Report, xv., 1886, p. 571, pl. xlii., figs. 5 a. b.

‡ *Op. cit.*, 569, pl. xlii., figs. 6 a. b.

§ Thesaurus Conch. I., 1847, pl. xxxii., figs. 21, 22.

SCALA OVALIS, Sowerby.

Tryon, *op. cit.*, p. 69, pl. xiv., fig. 40.

With doubt I refer here a species obtained on the lagoon shore.

SCALIOLA LAPILLIFERA, sp. nov.

(Fig. 8).

Shell ovate conical, broad for the genus, white, thin and translucent. Whorls seven, rounded, the earlier closely coiled, the later looser, surface obscurely marked by growth striæ. Apical whorls smooth and bare; the rest beset with adherent sand grains more closely disposed about and below the periphery. Aperture round, free from the preceding whorl, with expanded and reflected lip. Length 2, breadth 1 mm.

Three examples from the sandy beach of the lagoon.

This is smaller and proportionately broader than other *Scaliola* and especially differs by the almost solute whorls. It is less coated with adherent matter than *S. caledonica*.



Fig. 8.

IANTHINA, sp.

Specimens of an *Ianthina* too young to determine specifically occurred on the outer beach.

NATICA VIOLACEA, Sowerby.

Tryon, *Man. Conch.* viii., 1886, p. 18, pl. iii., fig. 41.

One dead and broken example from the beach of the lagoon.

Tryon quotes this from Fiji; Melvill and Standen from Lifu. In this Museum it is represented from the Bampton Reef, Coral Sea and New Caledonia.

NATICA MAROCHIENSIS, Gmelin.

Tryon, *op. cit.*, p. 22, pl. v., figs. 74–96; pl. vii., fig. 36; pl. viii., fig. 49.

Several dead shells occurred on the lagoon beach.

Melvill and Standen quote this from Lifu. In this Museum its Australian range is shown to be from Torres Straits to Sydney, and it is also represented from the New Hebrides, New Caledonia and Hawaii.

NATICA MAMILLA, Linne.

Tryon, *op. cit.*, p. 49, pl. xv., fig. 43; pl. xvi., figs. 46, 48; pl. xvii., figs. 65, 69.

One specimen was obtained attached to a native ornament as described ante p. 247.

This Museum contains representatives from Queensland, British New Guinea, New Caledonia and Hawaii.

NATICA MELANOSTOMA, *Gmelin*.

Tryon, *op. cit.*, p. 50, pl. xxi., figs. 13 – 18; pl. xxii., fig. 21.

A few empty shells were picked up on the beach of the lagoon.

Examples from Eagle Island, Queensland, British New Guinea and New Caledonia are shown in this Museum.

NATICA UMBILICATA, *Quoy & Gaimard*.

Tryon, *op. cit.*, p. 52, pl. xxii., fig. 26.

Several dead shells, not specifically distinguishable from this Australian species, were collected on the beach of the lagoon.

The Museum series show it to range from Adelaide to Sydney.

VANIKORO GUERINIANA, *Recluz*.

Tryon, *op. cit.*, p. 68, pl. xxix., fig. 62.

Several specimens were found alive in a crevice on the outer reef at low tide.

CAPULUS INTORTUS, *Lamarck*.

Tryon, *Man. Conch.* viii., 1886, p. 131, pl. xxxix., figs. 75, 76.

Several dead shells were collected on the beach of the lagoon.

Tyron quotes this from the Paumotus, and Melvill and Standen from Lifu. It is preserved in this Museum from Norfolk Island and Aneiteum, New Hebrides.

CAPULUS VIOLACEUS, *Angas*.

Tryon, *op. cit.*, p. 132, pl. xxxix., fig. 81.

Several specimens were gathered dead on the lagoon beach.

Examples of this species are before me from Sydney Harbour and the New Hebrides.

HIPPONYX AUSTRALIS, *Quoy*.

Tryon, *op. cit.*, p. 136, pl. xli., figs. 9 – 15.

Only found alive as a commensal on the opercula of the large *Pteroceras*.

Tryon cites this from Fiji and New Guinea, and Melvill and Standen from Lifu. It is in this Museum from Torres Straits.

MITRULARIA EQUESTRIS, var. *TORTILIS*, *Reeve*.

Tryon, *op. cit.*, p. 138, pl. xliii., figs. 53 – 59, 61 – 67.

Common dead in the high tide driftage on the shore of the lagoon. Once found alive in a crevice of a coral block.

TRUNCATELLA VALIDA, Pfeiffer.

Pfeiffer, Zeits. Malak., 1846, p. 182; Conch. Cab., i., "TruncateLLa," 1855, p. 11, pl. ii., figs. 7, 8, 19, 20, 21, 23.

TruncateLLa vitiana, Gould, Moll., U.S. Explor. Exped., 1852, p. 109, pl. viii., figs. 126, 126a, 126b.

Abundant at Funafuti where it has already been found by Graeffe.* This belongs to a semi-marine, semi-terrestrial assemblage of which I have already written that—"The smallest islands which possess any life at all are usually stocked by these forms, which appear to range from Ceylon in the west, to the Sandwich Islands in the east, and to be limited north and south by the tropics."†

Gould remarked that *T. vitiana*, admitted to be variable in size, "is not very different from *T. valida*." The differences in sculpture, small perforation, basal keel and posterior fusion of the ribs, on which he relied to separate the two, are shown by a series before me to be quite inconstant features. Smith says,‡ "When the genus is re-monographed, it is probable that some older name will be discovered to replace that of *valida*." A sentence which admirably expresses the assistance tendered by London writers to students of the Pacific Mollusca.

OMPHALOTROPIS ZEBRIOLATA, Mousson.

Mousson, Journ. de Conch., xiii., 1865, p. 181, pl. xiv., fig. 11; xxi., 1873, p. 108; Garrett, Proc. Zool. Soc., 1887, p. 308.

Omphalotropis rotumana, Smith, Ann. Mag. Nat. Hist., (6). xx., 1897, p. 552.

Abundant under sticks and stones on the main islet of Funafuti. It had already been found here by Graeffe, who also observed it at Nukufetau, Vaitupu, and Niutao in the Ellice, Nukuiona, Uvea, Kanathia, Fiji, and Wallis Island. Authentic specimens of the unfigured *O. rotomana* enable me to confidently unite this with Mousson's species. Some such conclusion seems indeed to have been anticipated by Smith, who alludes to this and others as likely to "eventually prove to be slight variations of already known species."

ASSIMINEA NITIDA, Pease.

Garrett, Proc. Zool. Soc., 1887, p. 314.

Abundant on Funafuti, where it had already been collected by Graeffe.

Garrett, who gives a complete bibliography says: "This small species is generally distributed throughout all the groups from the Paumotus to the Viti Islands and New Caledonia."

* Mousson—Journ. de Conch. xxi., 1873, p. 109.

† Hedley—Proc. Linn. Soc. N.S.W. (2) vi., 1891, p. 101.

‡ Smith—Journ. Malak. v., 1896, p. 21.

Rissoa invisibilis, sp. nov.

(Fig. 9).

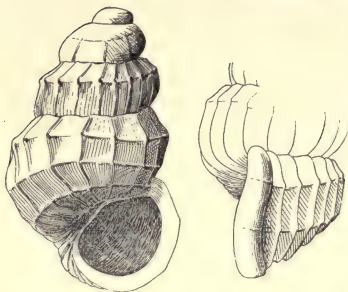


Fig. 9.

both it and the longitudinals vanish on the whorl above. The base is flattened, umbilicus narrow and deep. Aperture round, columella slightly sinuate, recurved over the umbilicus, lip with a heavy varix. Length 1.15, breadth .63 mm.

One specimen from the sand of the lagoon shore.

Shape and sculpture ally this to the group including *R. trajectus*, Watson. The heavy lip, open pattern of ornament, and comparative breadth of the shell clearly distinguish the novelty, one of the smallest of the genus, from any known form.

Rissoina exasperata, Souverbie.

(Fig. 10).

Souverbie, Journ. de Conch., xiv., 1866, p. 259, pl. ix., fig. 10.



Fig. 10.

To this species is referred with doubt a series from Funafuti. The published account is insufficient for accurate determination, and my principal reason for considering the Ellice shell to be *R. exasperata* is its identity with a common New Caledonian shell which I have myself collected at Panie, N.C., and have received from Noumea, from Mr. R. C. Rossiter. That Conchologist regards it as *R. exasperata*, and it answers fairly to Souverbie's description as far as that goes, but it is less easy to reconcile it with his figure.

This figure, perhaps drawn from a worn specimen, was so badly copied by Weinkauff* as to almost eliminate the name character and represents a smooth *exasperata*. Tryon unfortunately appears

* Conchylien Cabinet, i., 22, 1885, p. 54, pl. xiv., fig. 10.

to have accepted the copy, bad beyond recognition, as original, and copied it* in preference to Souverbie's. To the habitat he adds Fiji.

As a synonym I would add the name of *Rissoina quasillus*, Melvill and Standen† from Lifu. Neither figure nor description of this are sufficient for decision, we are not told how many ribs there are, whether continuous or discontinuous, etc., yet there seems nothing incompatible between *R. quasillus* and the shell under discussion. That these authors should have failed to institute a comparison between their supposed novelty and a shell so similar from the same locality, suggests that they overlooked Souverbie's description.

Since so much confusion has enveloped *R. exasperata*, it is not superfluous to present a drawing (Fig. 10) and remarks upon the Funafuti specimens.

Shell elongated, when well preserved slightly turriculated, varies slightly in being more slender or more stout. Dead shells are white. A fresh specimen has within the aperture four narrow, spiral lines of golden brown; outside, another such line colours the anterior spiral lyra of the antipenultimate whorl, two such the second and third of the penultimate, and three such the second, third, and fifth lyrae respectively of the ultimate whorl. Other worn specimens show traces of this colour pattern. On the last whorl there are nineteen or twenty stout, narrow, erect, longitudinal ribs, half the breadth of their interstices; these arise at the suture, and maintain an even size to the base, on attaining which they suddenly cease. These ribs are repeated on the preceding whorls; they are not continuous from whorl to whorl, but each arises and ends between the projections of predecessors and successors. They are fewer and relatively stronger on the earlier whorls, being indicated on the second and fully developed on the fourth.

On the last whorl there are five spiral cords, which are half the height of the longitudinal ribs. At the point of intersection a bead arises on the ribs. The hollows in the lattice work thus formed are square and are minutely spirally striated. The base is encircled by two or three small and finely beaded lyrae. Three spiral cords ascend for three whorls, growing weaker as they proceed. The first whorl is dome-shaped, and the second keeled.

These specimens are $2\frac{1}{2}$ to $3\frac{1}{2}$ mm. long, and have seven to eight whorls.

Occurred in the lagoon in shallow water.

The Chevert Expedition reported this species from Palm and Darnley Islands, Queensland. The Museum also possesses a series presented by Mrs. J. G. Waterhouse, who collected them at Lord Howe

* Tryon—Man. Conch., ix., 1887, p. 384, pl. lvii., fig. 96.

† Melvill & Standen—Journ. Conch., viii., 1897, p. 308, pl. xi., fig. 65.

Island. These measure 5 mm. in length, and have an additional spiral cord.

Though certainly distinct, *R. transenna*, Watson, has much resemblance to this species. *R. clathrata*, Adams, appears to differ slightly by coarser sculpture.

RISSOINA GEMMEA, sp. nov.

(Fig. 11).

Shell narrow, conical, white. Whorls eight (including two embryonic), rounded, suture lightly impressed. Embryonic whorls smooth, shining, apparently two, but a study of several species of the genus suggests that the topmost apparent whorl may contain several whorls wound in the same plane and concealed within the outermost. Sculpture—the last whorl is evenly and closely latticed by the intersection of eleven slender spiral cords, and about forty-two delicate longitudinal ribs; a smooth shining bead marks each crossing of the sculpture. The longitudinal ribs are slightly stronger than the spiral cords, a quarter of the breadth of their interstices, slightly oblique and curved; they cross regularly from base to suture and continue without stoppage at the suture, from whorl to whorl of the spire. Ascending the upper whorls, the spiral cords become fewer and gradually vanish leaving as vestiges a few denticles on the ribs. The spaces enclosed by the major sculpture are square shallow pits, spirally striated. Round the base are wound three or four irregularly beaded cords.



Fig. 11.

Aperture oblique, produced in front, contracted anteriorly to a short spout; columella sharply recurved at the base, extending across the body-whorl as a thick layer of callus; posteriorly the lip is sharply folded at its junction with the body whorl. The outer lip is much thickened, grooved upon the inner face, denticulate on the profile and with a heavy callus behind. Length 4, breadth $1\frac{1}{2}$ mm.

One specimen in shallow water in the lagoon.

In this species the grains seem to be smaller and more numerous than in any other beaded *Rissoina* described.

RISSOINA POLYTROPA, sp. nov.

(Fig. 12).

Shell ovate, fusiform, narrow, white. Suture impressed. Whorls seven, including two embryonic. The last whorl descends from the spiral plane of its predecessors until reaching the aperture, when it ascends suddenly and rapidly, the varix mounting up the preceding whorl for three tiers of spiral lyræ. The shell is thus

thrown out of symmetry with most *Rissoina*. Sculpture—as usual with the genus, the longitudinal sculpture predominates to begin with; the third, or first sculptured, whorl showing a few stout plications. On the following whorl fine spiral threads are visible in the interstices; on the whorl beneath these are magnified to substantial lyræ; and on the next or penultimate they have doubled in number, and rival the longitudinal in stature, at their intersection beads appear. On the last whorl the longitudinal, as such, have faded away, their influence showing in fine beads perceptible on the sutural and less distinct on a few of the nearer lyræ; the spiral lyræ have now increased to nearly thirty, the anterior smooth, the posterior with evanescent beading. These are sharply raised threads, half the width of their interstices, evenly arranged, extending from the suture to the anterior point of the shell where they are smaller and more crowded. Aperture almost perpendicular, oval, anteriorly with a short perpendicular spout which falls short of the anterior margin; columella broad, obliquely and sharply truncated. From this truncation a wide and thick callus extends across the body whorl to the posterior angle of the aperture. Here the lip is sharply bent. The outer bevelled lip projects broadly as a heavy varix crossed by fifteen of the spiral lyræ, the central couple of which are smaller and nearer together. Length $4\frac{1}{2}$, breadth 2 mm.



Fig. 12.

Five specimens in shallow water in the lagoon.

The extinction of longitudinal and the supremacy of spiral sculpture is unfrequent in the genus. Such species have been separated by Nevill as the Section *Morchiella*. From all there included the novelty differs by smaller size, more numerous lyræ, and truncated columella.

RISSOINA PLICATA, Adams.

(Fig. 13).

Adams, Proc. Zool. Soc., 1851, p. 264; Mohrenstern, Denk. Akad. Wiss., xix., 1860, p. 125, pl. iii., fig. 21; Weinkauff, Conch. Cab., i., 22, 1885, p. 23, pl. viii., figs. 5, 6.

Rissoina turricula, Pease, Proc. Zool. Soc., 1860, p. 438.

Two specimens from Funafuti are thus determined. The species appears to vary greatly in size. Whereas the type is described as being $5\frac{1}{2}$ mm. long, the Ellice examples are but $2\frac{1}{2}$ mm. The



Fig. 13.

development of the basal rib, and the number of longitudinal plications vary also. The transverse markings are not grooves, as Adams' description would mislead one to suppose, but elevated threads. The difficulty I found in naming this species induces me to offer a drawing for the assistance of others.

Authentic specimens of *R. turricula*, Pease, from Hawaii, enable me to unite it with the above, a conclusion which Weinkauff's bad figures would not have suggested.

A specimen from British New Guinea is contained in this Museum. Tryon quotes *R. turricula* from Fiji.

RISSOINA AMBIGUA, Gould.

Gould, Moll., U.S. Explor. Exped., p. 217, pl. xv., figs. 261a-c; Tryon, Man. Conch., ix., 1887, p. 371, pl. lv., figs. 27, 29, 31, 35; pl. liv., fig. 7.

A few worn specimens were collected on the lagoon beach. They belong to a variety with smaller and more numerous ribs on the last whorl than the type.

This is one of the most abundant and widespread species in the Pacific. It was first found in the Paumotu Group. I have seen specimens from Tahiti. Pease found it in the Hawaiian and Garrett in the Fijian Islands. I have collected it in Port Moresby, New Guinea, and again at Panie, New Caledonia.

RISSOINA AFFINIS, Garrett.

Garrett, Proc. Acad. Nat. Sci. Phil., 1873, p. 212, pl. ii., fig. 10.

One specimen from the lagoon beach resembles Garrett's figure and description, but differs in being microscopically striated above and below the periphery, and also in being eight instead of 5 mm. long.

RISSOINA SPIRATA, var. *SUPRACOSTATA*, Garrett.

Garrett, *loc. cit.*, p. 209, pl. ii., fig. 1; Tryon, *loc. cit.*, p. 388.

A small specimen, even more drawn out than Garrett's figure, from the lagoon beach.

DIALA VIRGATA, sp. nov.

(Fig. 14).

Shell imperforate, narrow, regularly conical, obtusely angled at the periphery, blunt at the tip, surface dull. Colour most variable, typically about half-a-dozen broad, irregular, opaque, white stripes extend longitudinally upon a translucent white ground from the suture to beyond the periphery of the last whorl, and cross the full breadth of the earlier ones. The translucent ground, but not the opaque patches, are crossed by an indefinite number, commonly

from eight to sixteen, spiral brown threads. These lines sometimes coalesce and produce a colour pattern of opaque white blotches on a dark chestnut ground. The opaque white spaces vary in number and extent; when restricted they appear as a series of rhombs on the periphery and triangles on the suture; by confluence these form longitudinal ragged stripes and separate the barred or brown tracts into rough ovals. This colouration is visible within the aperture. Sculpture—longitudinal growth lines are perceptible; the whole body whorl is evenly spaced by about a dozen, wide, very shallow grooves, upon the narrow intervening ridges of which are apt to occur the chestnut bars; the peripheral groove is the most distinct. Whorls seven, gradually increasing, slightly rounded; embryonic whorl one, minute, turbinate. Suture deeply impressed. Aperture slightly oblique, ovate, pointed posteriorly, rounded and effuse anteriorly; columella reflected, stained medially with chestnut; callus on body whorl slight, outer lip straight, simple. Operculum thin, corneous, ovate, paucispiral. Length $2\frac{3}{4}$, breadth $1\frac{1}{2}$ mm.



Fig. 14.

Very abundant; alive on stones and shells in shallow water in the lagoon.

This species differs from *D. albugo*, Watson, and *D. ludens*, Melvill and Standen, by a dull instead of a glossy surface, and by the opaque tracts occurring in larger continuous sheets instead of being scattered in small and numerous dots.

From the description of *Rissoa flammea*, Pease,* I suppose that it is either the same or very like the shell before me.

DIALA HARDYI, Melvill & Standen.

Melvill & Standen, Journ. Conch., viii., 1895, p. 118, pl. ii., fig. 10.

This species is common in the lagoon. I have identified it with a species I took at Panie, New Caledonia, which answers to the account of the Lifu shell.

SOLARIUM HYBRIDUM, Linne.

Tryon, Man. Conch. ix., 1887, p. 14, pl. v., figs. 59 – 62.

A dead example from the lagoon beach.

Recognised by Melvill and Standen from Lifu, by Schmeltz from Samoa, Tonga, and Cook's Islands, and represented in this Museum from Teste Island, Louisiades.

* Pease—Am. Journ. Conch., iii., 1867, p. 297, pl. xxiv., fig. 33.

HELIACUS DISCOIDEUS, Pease.

Tryon, *loc. cit.*, p. 21, pl. vi., fig. 6.

One dead shell from the shore of the lagoon. Previously known only from the Paumotus.

LITTORINA OBESA, Sowerby.

Tryon, *loc. cit.*, p. 247, pl. xliii., fig. 53.

In great profusion at and above high water-mark, on stones and even tree stems, on the windward beach of the atoll, in company with *Nerita*, *Truncatella*, and *Melampus*.

Recorded by Melvill and Standen from Lifu, by Smith* from Rotuma, and shown in this Museum from Eddystone Island (Solomons), Vate (New Hebrides), the Gilberts, and Fanning Island.

MODULUS TECTUM, Gmelin.

Tryon, *loc. cit.*, p. 260, pl. xlviii., figs. 87-89.

One dead shell was found on the beach of the Funafuti lagoon.

Tryon quotes this from Fiji and Hawaii; Melvill and Standen from Lifu. It is in this Museum from New Caledonia.

RISELLA CONOIDALIS, Pease.

Tryon, *loc. cit.*, p. 263, pl. l., fig. 38.

Dead shells were not uncommon on the sandy beach of the lagoon.

The species was originally described from the Paumotus. I have collected it at Panie, New Caledonia. Schmeltz mentions it from Tahiti. There can, I think, be little doubt that the shell described twelve years later from Lifu by Montrouzier† as *Echinella gaidei* is identical.

PLESIOTROCHUS SOUVERBIANUS, Fischer.

Tryon, *loc. cit.*, p. 264, pl. l., figs. 44-46.

Not rare as dead shells on the sandy shore of the lagoon. Originally described from Lifu.

FOSSARUS LAMELLOSUS, Montrouzier.

Tryon, *loc. cit.*, p. 271, pl. lii., fig. 7.

Three dead shells were found on the beach of the Funafuti lagoon. The type from New Caledonia is described as imperforate, but these have a deep and narrow umbilicus.

PLANAXIS SULCATUS, Born.

Tryon, *loc. cit.*, p. 276, pl. lii., figs. 22-27, 31, 32.

* Smith—Ann. Mag. Nat. Hist., (6) xx., 1897, p. 523.

† Montrouzier—Journ. de Conch., xxvii., 1879, p. 62, pl. iii., figs. 3, 3a.

I found this gregarious species in great numbers under stones between tide marks on the lagoon shore of Funafuti. Tenison Woods has described this as occurring in similar positions and abundance in tropical Queensland.*

In this Museum it is represented from Torres Straits and Port Molle, Queensland, and the Solomons.

PLANAXIS LINEATUS, Da Costa.

Tryon, *loc. cit.*, p. 278, pl. liii., figs. 49 - 57, 59, 63 - 66; pl. lii., figs. 38 - 48.

This species is also markedly gregarious. Little colonies occurred under stones between tide marks on the outer reef of Funafuti.

Tryon mentions this from the Solomons, Tahiti and Paumotu. Melvill and Standen record it under the synonym of *P. virgatus*, Smith, from Lifu. Smith gives it from Fiji.† I have collected it at Oubatche, New Caledonia, and this Museum has it from Hawaii and the New Hebrides.

MELANIA MAGENI, Gassies.

Gassies, Faune Conchyliologique de la Nouvelle Calédonie, 1863, part i., p. 95, pl. vi., fig. 10.

Abundant in the native wells at Funafuti.

First described from New Caledonia, and lately recognised by Smith from Rotuma. Contrary to the priority given by Brot and Crosse this species has page precedence over *M. montrouzieri*, Gassies.

CAECUM VERTEBRALE, sp. nov.

(Fig. 15).

Caecum sp., De Folin, Challenger Reports, Zoology, xv., 1886, p. 684, pl. ii., fig. 12.

Shell of moderate size for the genus, white (? bleached), rather curved, slightly tapering, ornamented with twenty-five strong, pretty regular rounded, transverse rings, which are separated by interstices of corresponding breadth and depth. Septum a low rounded dome. Length 2.15, breadth .56 mm.

A single perfect specimen, gathered on the sandy shore of the lagoon, is with some confidence identified with a nameless fragment dredged by the "Challenger" off Honolulu.



Fig. 15.

* Tenison Woods—Proc. Linn. Soc. N. S.W., v., 1881, p. 108.

† Smith—Journ. Linn. Soc., Zool., xii., 1876, p. 552.

CAECUM EXILE, *De Folin*.

De Folin, loc. cit., p. 687, pl. iii., figs. 20 – 22.

Four specimens of this were collected with the preceding. That two are a pale umber colour suggests that the unique shell dredged by the "Challenger" off Tongatabu and described as crystalline, was faded. I have also taken this at Panie, New Caledonia.

CAECUM GULOSUM, *sp. nov.*

(Fig. 16).



Fig. 16.

Shell white, slender, rather curved, suddenly expanded behind the aperture, concentrically sculptured by fine close threads which grow coarser anteriorly. Septum much exerted, flattened distally and with two rough ring ridges. Length 1·8, breadth ·4 mm.

One specimen from the lagoon beach.

Nearest to *C. attenuatum* which is narrower and more curved, also allied to *C. amputatum*, Hedley,* from which it differs by being smaller and of a more slender build.

VERMETUS MAXIMUS, *Sowerby*.

(Fig. 17).

Tryon, *Man. Conch.* viii., 1886, p. 184, pl. lv., figs. 89, 90 ;
Morch, *Proc. Zool. Soc.* 1861, p. 166.

The Funafuti people consider this species good food, and call it "gea." It occurs in abundance in large clumps of *Millepora* growing on the lagoon side of the southern horn of the main islet. Here the earlier and irregularly coiled whorls were imbedded in the coral mass, but the last half foot of the tube stood up erect and free. What I consider the same species also grew, though rarely, on the outer reef-flat at low water, where it was altogether prostrate and had a more pronounced keel.

One fine specimen is thirty-five mm. across the aperture. Within the shell is white, smooth and porcellanous, at the slightly everted lip it has a faint purple tinge which soon fades. Externally it has a longitudinal, dorsal keel or crest, and is concentrically furrowed by growth lines. The distal part of the tube is, perhaps as a repair after injury, sometimes plugged with a shelly wad.

The animal is bold and active, if touched it shrinks two or three inches down the tube, but soon recovers confidence and rises to the aperture. The mantle margin is sometimes entire, sometimes notched dorsally. The long thick retractor or columella muscle is ventral.

* Hedley—*Proc. Linn. Soc. N.S.W.*, (2) viii., 1893, p. 504, fig.

Beneath the head is a flap terminating anteriorly in two processes and arising from a deep cleft between the mouth and the operculum. Treating of the same or an allied species from Guam, Quoy and Gaimard* describe this as an anti-buccal appendage and figure it from above. I regard it as the relic of a degenerated propodium. The accompanying sketch (Fig. 17) in profile, of an animal half drawn out of the shell and stript of the operculum, will better convey an idea of this organ than figures taken from above.



Fig. 17.

When a gasteropod retreats into the shell it doubles the foot either lengthwise, as in some inoperculate forms, or across, as in most operculates. In the latter case when completely retracted, the foot is so folded head to tail that the anterior half of the sole is applied to the posterior; the operculum then closes the aperture. In a sedentary form this position of retraction might become permanent. Where the foot never serves for progression, but continues to maintain a useful operculum, it is easy to imagine that the fore part of the folded foot would become atrophied and that as it diminished the hind part would enlarge. This is the history suggested for the shrunk propodium of *Vermetus*, which lies tucked away between the mouth and the operculum. The process of evolution perhaps continued in the direction of utilising the appendices of the propodium as tentacles.

This species was collected by Hugh Cuming at Marutea, Paumotu, and opercula of it were received from Lifu by Melvill and Standen. In a preceding article (p. 243) I have quoted a description of a mollusc from Mangaiia, called "ungakoa," which is probably this. In Java it is known as "karang," which Morch translates as "coral tube." The only Pacific shell with which this can be confused is the pipe-like *Kuphus arenarius*, L.

VERMETUS, sp.

A second species of this genus, somewhat resembling *V. grandis*, Gray,† or *V. imbricatus*, Dunker, also occurred.

TURRITELLA CONCAVA, Martens.

Tryon, *loc. cit.*, p. 206, pl. lxiv., fig. 6.

* Quoy & Gaimard—Voy. "Astrolabe," Zoologie, iii., 1835, p. 295, pl. lxvii., figs. 13–15.

† Tryon—Man. Conch., viii., 1886, p. 182, pl. liv., fig. 79.

Two imperfect shells from the lagoon correspond to examples of this Mauritian species.

STROMBUS LENTIGINOSUS, *Linne.*

Tryon, *Man. Conch.* vii., 1885, p. 110, pl. iii., figs. 23, 24.

One dead shell I picked up on the Funafuti beach.

Tryon gives the localities of New Caledonia and Fiji; in this Museum it is from British New Guinea and the Solomons.

STROMBUS FLORIDUS, *Lamarck.*

Tryon, *loc. cit.*, p. 119, pl. vii., figs. 73 - 76, 80, 83.

Abundant alive in shallow water in the lagoon, associated with *S. luhuanus*.

Cuming saw this in the Society Islands, Tryon quotes it from Fiji, and Von Martens from Samoa.* It ranges along the Australian coast south to Sydney. In this Museum it is represented from Teste Island, Louisiades, Erromanga, New Hebrides, and Hawaii.

STROMBUS DENTATUS, var. *RUGOSUS*, *Sowerby.*

Tryon, *loc. cit.*, p. 119, pl. vii., fig. 72.

Abundant alive in the Funafuti lagoon.

Schmeltz records this from Samoa and Tonga.†

STROMBUS HEMASTOMA, *Sowerby.*

Tryon, *loc. cit.*, p. 120, pl. vii., fig. 78.

Recorded from the Ellice Group by Schmeltz.‡

STROMBUS TERESELLATUS, *Sowerby.*

Tryon, *loc. cit.*, p. 121, pl. viii., fig. 87.

Alive, with the preceding, but uncommon.

Tryon notes this from Fiji, and it has already been recorded from the Ellice Group by Schmeltz. It is shown in this Museum from New Guinea.

STROMBUS GIBBERULUS, *Linne.*

Tryon, *loc. cit.*, p. 121, pl. viii., fig. 85.

Only seen in a dead state on the beach of the Funafuti lagoon.

Cuming found this at the Society Islands. Tryon gives it from New Guinea, Fiji, and the Paumotu; and Melvill and Standen from Lifu. It is in this Museum from Torres Straits, Louisiades, and New Hebrides.

* Martens—*Journ. Linn. Soc., Zool.*, xxi., 1839, p. 189.

† Schmeltz—*Mus. Godeffroy, Cat.* v., 1874, p. 112.

‡ Schmeltz—*Loc. cit.*, p. 142.

STROMBUS SAMAR, *Dillwyn.*

Tryon, *loc. cit.*, p. 121, pl. viii., fig. 88.

Mr. G. Sweet procured one specimen.

STROMBUS LUHUANUS, *Linne.*

Tryon, *loc. cit.*, p. 122, pl. viii., figs. 91, 92.

Abundant alive on sandy patches between rocks in the lagoon of Funafuti. The natives call it "paneia" and esteem it as food.

Tryon quotes it from New Guinea and Fiji, and Melvill and Standen from Lifu. It extends along the Australian coast south to Sydney.*

PTEROCERA AURANTIA, *Lamarck.*

Tryon, *loc. cit.*, p. 124, pl. ix., fig. 5.

One imperfect but recognisable specimen from Funafuti.

Schmeltz quotes this from Samoa and the Carolines.† It is in this Museum from Fiji.

PTEROCERA BYRONIA, *Gmelin.*

(Fig. 18).

Tryon, *loc. cit.*, p. 124.

A native guided me to the haunt of this mollusc, a gravel flat on the western side of the lagoon, on which the water was waist-deep at low tide. Here I collected numerous living examples. All the older specimens, though alive, had lost the fingers of the shell, which disfigured them almost beyond specific recognition. (Fig. 18). Mr. Whitelegge has pointed out to me that the callous lining of the aperture is everywhere perforated by some vegetable organisms, probably algæ. He suggests that their action has resulted in these mutilations.

On the opercula of most specimens were seated a couple of *Hippomyx australis*, Quoy.

The natives, who termed it "karea," valued it for food both raw and roasted, and in ancient times used it as an edge for various implements. By mistake, I have referred to this species in preceding pages (pp. 67 and 263) as *P. lambis*.

Cuming collected this species in the Society islands, the Chevert Expedition in Torres Straits, and specimens have been received by this Museum from Erromanga, New Hebrides.



Fig. 18.

* Hedley—Proc. Linn. Soc. N.S.W., xxi., 1896, p. 88.

† Schmeltz—Mus. Godeffroy Cat. v., 1874, p. 141.

PTEROCERA RUGOSA, Sowerby.

Tryon, *loc. cit.*, p. 126, pl. x., fig. 12.

I saw a living specimen in the hands of another member of our party, and picked up a dead shell on the beach.

Cuming found this at the Society Islands. New Caledonian examples are contained in this Museum.

TEREBELLUM SUBULATUM, Lamarck.

Tryon, *loc. cit.*, p. 131, pl. xi., figs. 27 - 30.

Only twice seen, and that in a dead state, on the shore of the Funafuti lagoon.

Schmeltz records this from Samoa, Fiji, and the Pelews. The Chevert Expedition took it in Torres Straits. Melvill and Standen cite it from Lifu. In this Museum it is from the Bampton Reef and Aneiteum, New Hebrides. I have also taken it at Port Moresby, British New Guinea, and Noumea, New Caledonia.

CERITHIUM NODULOSUM, Bruguière.

Tryon, *loc. cit.*, ix., 1887, p. 122, pl. xix., figs. 13, 14; pl. xx., fig. 15.

A small form, only 70 mm. or so in length, was not uncommon alive at low water mark on the reefs in the lagoon. This species was observed in Torres Straits by the "Chevert" Expedition.

CERITHIUM COLUMNA, Sowerby.

Tryon, *loc. cit.*, p. 123, pl. xx., figs. 17 - 20.

Frequent on the lagoon beach. It is represented in this Museum from Moreton Bay, Queensland, New Caledonia, Fanning Island and Hawaii. Smith reports it from San Christoval, Solomons, Schmeltz from Samoa and the Paumotus, and Melvill and Standen from the Loyalties; it was taken in Fiji by the "Challenger," and in Torres Straits by the "Chevert" Expeditions.

CERITHIUM CITRINUM, Sowerby.

Tryon, *loc. cit.*, p. 123, pl. xx., figs. 21 - 23.

Three specimens of a dwarf form, only 7 mm. long, from the lagoon beach are referred to this species. Already recorded from the Ellice by Schmeltz.

CERITHIUM ECHINATUM, Lamarck.

Tryon, *loc. cit.*, p. 123, pl. xx., figs. 25 - 27.

One example. Hugh Cuming collected this at Anaa, Paumotus.

CERITHIUM MACULOSUM, *Mighels*.

Kobelt, Conch. Cab., "Cerithium," 1895, p. 499, pl. xxxv., figs. 18, 19.

One dead shell from the lagoon beach. Also occurs at Hawaii.

CERITHIUM ROSTRATUM, *Sowerby*.

Tryon, *op. cit.*, p. 130, pl. xxiii., figs. 90, 91.

Three specimens from the lagoon beach. There are examples in this Museum from the New Hebrides; Pease observed it in Hawaii; Hugh Cuming at Marutea, Paumotu; Brazier at San Christoval, Solomons; the "Chevert" took it in Torres Straits, and Tryon gives it from Fiji.

CERITHIUM OCEANICUM, *sp. nov.*

(Fig. 19).

Shell rather elongate, almost truncate anteriorly. Colour uniform chocolate. Whorls eight, the upper biangulate, the last equal in length to the remainder. Sculpture: there are on the penultimate whorl (including varices) twenty low, rounded, longitudinal ribs, which crenulate the suture. These cross regularly from whorl to whorl, becoming fewer but proportionately stronger as they ascend the spire; on the last whorl they become evanescent. Two spiral lines of granules descend the spire, appearing on the crest of each rib as a smooth boss. On the body whorl there are besides, beneath these, three spiral lines in which the beads have nearly fused into a smooth continuous ridge, the uppermost of these is sometimes apparent in the spire as a super sutural fasciole. The whole surface of the shell except the beads, is covered by close, microscopic, raised spiral hair lines. Three, obliquely ascending, continuous lines of varices mount the spire a third of a whorl apart. Aperture slightly oblique, semi-lunate; anterior canal hardly more than a notch, directed sideways; columella anteriorly truncated, externally wrinkled and curved downwards and outwards, internally with a low ridge-tubercle, callus on body whorl medium; outer lip strongly variced behind, edge sharp, notched by the major spiral sculpture, finely grooved within. Length 8, breadth 4 mm.



Fig. 19.

A single, perhaps not quite adult specimen from the lagoon beach.

This shell seems to be a dwarf of the species which Sowerby has figured* as "*Cerithium granosus*, Kiener." The shell which Kiener himself figures† so differs in contour, sculpture, size,

* Sowerby—Thesaurus Conch. ii., 1855, pl. clxxxii., fig. 123, 124.

† Kiener—Coquilles Vivantes, Canaliferes i. (n.d.), pl. iv., fig. 5, p. 57.

colour and details of the aperture, that Sowerby's determination can only be considered as one of the blunders which so plentifully occur in his works.

CERITHIUM BREVE, var. *ELLICENSIS*, var. nov.
(Fig. 20).

Shell conical, blunt in front and tapering somewhat rapidly behind. Colour cream. Apex of the only example broken, remaining whorls seven, of which the upper are much eroded. Sculptured by low rounded longitudinal ribs which crenulate the suture and project at the periphery, on the antipenultimate there are thirteen of these, on the penultimate fifteen, and on the last whorl where they tend to disappear, there are counting varices, eleven. The last whorl is girdled by six, the earlier by two zones of raised and polished callus, which swell into greater prominence on the crest of each rib. The space between these zones is scored by sharp, narrow, revolving grooves, widest apart in the centre.



Fig. 20.

Behind the aperture is a broad outstanding varix which ascends the penultimate whorl to the lower callus zone. Half a whorl further back is another but much weaker varix. No varices can certainly be distinguished on the spire, though some slightly more prominent ribs there suggest them. Aperture perpendicular, oval, anterior canal short, oblique and deeply cut; inner lip with a heavy layer of callus terminating above and below in a ridge tubercle. Anteriorly and externally the columella is reflected, not appressed to the shell. Outer lip within much thickened, armed with seven entering ridges of callus. Length 10, breadth 5 mm.

One specimen from the lagoon beach, differs from type by smaller size and less prominent sculpture.

Of the figures accessible to me, this form most resembles those of *C. hanleyi*, Sowerby, and *C. rubrolineatum*, Sowerby,* from which it seems to differ by smaller size, absence of coloured bands, and apparently different arrangement of the teeth of the aperture. Tryon unites these two, and comments severely on this author's nomenclature. Sowerby himself, by a negligence truly remarkable, omits both from his later Monograph in the Conchologia Iconica. The original figure of *C. breve*† seems to be badly drawn. As Kiener had access to the original specimens of Quoy and Gaimard, I would rather base an identification on his different but well drawn figure.‡ Smith has suggested§ that "*C. breve* may be

* Sowerby—Thesaurus Conch. ii., 1855, pl. clxxxiii., figs. 193 and 199.

† Voy. "Astrolable," Zool., 1835, pl. liv., fig. 9.

‡ Kiener—Loc. cit., pl. xiv., fig. 2.

§ Smith—Mollusca, Zool. Coll. "Alert," 1884, p. 65.

only a form of *C. morus*, Lamk." Tryon, ever ready to reduce synonymy, agreed in this view. Whatever may be deemed the value of *C. breve*, it cannot be adjudged an absolute synonym of *C. morus*.

The type of *C. breve* came from Tongatabu. The shell does not seem to have been again observed.

CERITHIUM SPICULUM, sp. nov.

(Fig. 21).

Shell narrow, subulate, with a sharply-pointed spire and a rounded base. Colour dull white, distantly, faintly, irregularly, and minutely spotted with chestnut. Whorls eleven, slowly increasing, somewhat turreted, flattened. Sculpture—on the uppermost whorls the spiral ridges are tuberculated by longitudinal plications which rapidly diminish as the growth proceeds. On the last whorl their influence is barely perceptible in faint, shallow, longitudinal undulations. A stout varix occurs a third of a whorl behind the aperture; from four to ten, raised, spiral cords encircle each whorl, in the interstices of which are fine spiral threads. Aperture perpendicular, oval; outer lip straight and sharp; canal very short, turned abruptly outwards. Length 11, breadth 4 mm.



Fig. 21.

Two specimens were obtained in the outer beach of Nukulailai.

This form appears allied to *C. lacteum*, Kiener,* from which it differs by smaller size, narrower outline, and absence of granulations.

CERITHIUM STRICTUM, sp. nov.

(Fig. 22).

Shell narrow, elongate, tapering in a slender spire and blunt anteriorly. Colour white, irregularly longitudinally splashed with chestnut. Whorls seven, the upper angled, the last straight. Sculpture—round the angle of the upper whorls runs a line of tubercles, of which eleven occur on the penultimate. Very slight longitudinal undulations, hardly to be called ribs, extend from these tubercles across the whorl; both vanish before attaining the last whorl. This latter is girt with about twenty, sharp, revolving ridges, of which the central is largest and corresponds to the tuberculated angle of the earlier whorls; the rest vary in size and spacing, the basal ridges being least and closest; the upper seven ascend the spire. A large varix is behind the aperture, and a



Fig. 22.

* Kiener—Coquilles Vivantes, Canaliferes i., (n.d.), p. 58, pl. vii., figs. 3, 3a.

weaker one half a whorl back, none else appear. Aperture perpendicular, oval. Outer lip smooth within, sharp edged, crenulate outside, inner lip excavate, thickly lined with callus, with a posterior nodule at the margin of the channelled angle. Length 7, breadth 3 mm.

A single specimen from the lagoon beach.

This species seems related to *C. maculosum*, Mighels; it is far more slender, and differs in that the revolving line of tubercles fails to attain the last whorl.

CERITHIUM VARIEGATUM, Quoy & Gaimard.

Tryon, *loc. cit.*, p. 134, pl. xxiv., figs. 41, 43, 45, 65, 66.

Some imperfect examples collected by Mr. Sweet are with hesitation so determined.

CERITHIUM ZEBRUM, Kiener.

Tryon, *loc. cit.*, p. 137, pl. xxv., figs. 71, 72.

I refer to this species a small shell abundant on the lagoon beach, 7 mm. long, variously coloured—brown, cream, mauve and salmon, unbanded and banded. No really satisfactory figure or description of it exists, the earliest is much the best. Melvill and Standen, who recognise it from the Loyalties, erroneously state that it was originally described from the Galapagos, whence Sowerby reported it. The locality given by Kiener himself* is Mauritius. Tryon adds Samoa. I found it in Port Moresby, British New Guinea and at Oubatche, New Caledonia. It is represented in this Museum from the New Hebrides. So widespread and variable a species probably possesses a synonymy to match. I agree with Langkavel's† remark that *C. ianthinum* of Gould, should be here included, which would extend the geographical range of the species to Tahiti and the Paumotus. It is likely that *C. unilineatum*, Pease and *C. dichroum*, Melvill and Standen should be reduced to *C. zebrium*. Pease adds *C. aspersum*, Deshayes as a synonym.‡

CERITHIUM IMPENDENS, sp. nov.

(Fig. 23).

Shell strong, stout, regularly conical, each of the upper whorls overhanging the next, bi-angled above the suture, heavily variced on the back of the last whorl. Colour—upon a white ground is painted ochre-yellow, in one instance chocolate, which chiefly prevails on the base and between the ribs, thus accentuating the projections to the eye. Whorls eight, suture deeply impressed. Sculpture—peculiar buttress ribs ornament the

* Kiener—Coquilles Vivantes, Canaliferes i., (n.d.), p. 72.

† Langkavel—Donum Bismarckianum, 1871, p. 25.

‡ Pease—Am. Journ. Conch. vii., 1872, p. 75.

spire, the penultimate whorl has ten and those above a proportionate decrease; they are weak at the suture, which they barely sinuate, and gain in breadth and height as they cross the whorl, projecting over the suture beneath them. They do not cross continuously from whorl to whorl, nor do they regularly alternate; they grow evanescent on the last whorl and cease with a stout and heavy varix one-third of the whorl behind the aperture. In this latter space, reminiscences of them occur as tubercles on the angle and at the suture. On the last whorl about twenty fine spiral threads are evenly distributed between the suture and the anterior point of the shell; the uppermost of these ascend the spire and are alike prominent on ribs and interspaces. Aperture perpendicular, subtriangular; columella sharply sinuate, anterior notch not produced into a canal; callus on body whorl slight; outer lip thickened slightly and reflected, angled sharply at the posterior insertion. Length $4\frac{1}{2}$, breadth 2 mm.



Fig. 23.

Seven examples from the lagoon beach. Perhaps this is a member of the subgenus *Colina*.

CERITHIUM PIPERITUM, Sowerby.

Tryon, *loc. cit.*, p. 144, pl. xxvii., figs. 31, 32.

Mr. G. Sweet procured a few dead shells of this species at Funafuti. It had previously been recorded from the Ellice by Schmeltz, and also from Upolu and Rarotonga. There are examples from Tahiti in this Museum.

CERITHIUM OBELISCUS, Bruguère.

Tryon, *loc. cit.*, p. 146, pl. xxvii., fig. 39.

One specimen from the lagoon beach. Melvill and Standen report this from the Loyalties; Schmeltz from Fiji and Cook's Islands; and Smith from Tonga.* In this Museum it is represented from Cooktown and Port Curtis, Queensland, also New Caledonia, Lord Howe Island and Hawaii.

CERITHIUM OBELISCUS, var. *CEDO-NULLI*, Sowerby.

Tryon is here followed in reducing this to varietal rank. In Funafuti it is represented by an extremely small and stout individual, 22 mm. long. First found at Anaa, Paumotus.

CERITHIUM ASPERUM, Linne.

Tryon, *loc. cit.*, p. 148, pl. xxviii., figs. 62, 63.

One of the commonest shells on the lagoon beach; the lineated form dominant. It was taken by the "Chevert" in Torres Straits,

* Smith—Proc. Zool. Soc., 1891, p. 416.

by the "Challenger" at Fiji and Tonga, and under the synonym of *C. lineatum*, Lk., is reported by Melvill and Standen from the Loyalties; and by Schmeltz from Cook's Islands.

CERITHIUM PHAROS, *Hinds*.

Tryon, *loc. cit.*, p. 149, pl. xxix., fig. 68.

Mr. G. Sweet brought one specimen from Funafuti. Tryon reports this from Fiji and the Paumotu. In this Museum it is represented from New Caledonia, New Hebrides, and Hawaii.

CERITHIUM ELEGANTISSIMUM, sp. nov.

(Fig. 24).



Fig. 24.

Shell tall, narrow, ovate fusiform, with a prominent varix behind the last whorl, flattish beaded whorls and a deeply excavated suture. Colour, russet brown, shading on the base into burnt umber, irregularly picked out on longitudinal ribs with white. Whorls eleven, rather flattened, separated by deep and sharply incised sutures, last whorl almost equalling in length the remainder, and no broader than the penultimate. Sculpture—weak longitudinal ribs continuously and perpendicularly cross the lower three whorls, fading away on the periphery of the last. These form gemmules on the spiral cords; on the earlier whorls these can be also traced. A particularly stout varix occurs on the last whorl opposite the aperture, a corner of which is shown in the illustration. Immediately beneath the suture winds a slender cord; four spiral rows of gemmules encircle the space between it and the periphery, the uppermost of which tends to split into two; the remaining space between the periphery and the anterior extremity is occupied by seven simple cords which become more slender and close anteriorly; the upper whorls have but two beaded cords. The aperture is perpendicular and oval, strongly variced without and consequently shelved within; columella arched, with a thick brown callus; canal very short and wide, slightly recurved. Length 5, breadth 2 mm.

Abundant on stones in shallow water in the lagoon at Funafuti.

A specimen before me from Thursday Island, Queensland, differs slightly from the above in the greater prominence of the longitudinal ribbing.

CONTUMAX, gen. nov.

A genus of the Cerithiidae, nearest allied to *Cerithiopsis*. It shares with that the excavated base, the produced canal, and the unfinished aperture; but differs by greater size, broader shell,

more rapidly increasing whorls, different plan of sculpture, and especially by a habit of plugging and breaking off the upper whorls from time to time. Animal unknown.

Type.—*C. decollatus*, Hedley.

The genus is founded on a species from Funafuti. I have also a cogeneric but apparently distinct species from Oubatche, New Caledonia, which is 15 mm. long; white, with a few scattered brown dots; without the longitudinal plications of the Funafuti species, but rather more distinctly cancellated by longitudinal sculpture. I am also disposed to include under *Contumax* the species which Melvill and Standen describe* as *Mathilda eurytima*, whose "canali producto" so ill agrees with *Mathilda*. Perhaps this *M. eurytima* may be the young of the Oubatche shell just mentioned. The genus is also represented from Torres Straits.

CONTUMAX DECOLLATUS, sp. nov.

(Fig. 25).

Shell narrow, conical, above rounded, below turreted, solid, invariably decollated. Colour, dull white. Whorls of an uncertain number, the specimen figured has seven, and I estimate that five more have been lost. Sculpture—the shell has three stages, which merge into each other, but which apart might seem to belong to different species. None of a fairly large series before me show the apical whorls, the summit being in every instance and in successive stages broken off. The youngest whorl before me is rounded and crossed by several fine raised spiral lines. Later the median line enlarges and originates an angle, and a faint longitudinal sculpture appears. Further on, the whorl is sharply angled by a strong keel, below which are two minor keels, and on the shelf above are five delicate spiral lines, all of which are more or less beaded by transverse sculpture. On the antepenultimate whorl commence longitudinal plications which rapidly develop to their maximum on the last whorl. Here they are six in number, oblique, commencing at the suture, most prominent on the shoulder and vanishing at the basal keel.

The base is hollow, overhung by a thick basal ridge, within which is a second lesser one, the remainder of the base being faintly concentrically striated. Aperture scarcely oblique, squarish,



Fig. 25.

* Melvill & Standen—Journ. Conch. viii., 1896, p. 310, pl. xi., fig. 73.

lip simple, sharp, columella arched, canal produced and recurved. Length 18, breadth 8 mm.

Several dead specimens collected on the lagoon beach of Funafuti.

CERITHOPSIS EUTRAPELA, Melvill & Standen.

Melvill & Standen, Journ. Conch., viii., 1896, p. 301, pl. x, fig. 52.

Three specimens, one mauve, the others white, from the lagoon beach of Funafuti.

CERITHOPSIS ELECTRINA, sp. nov.

(Fig. 26).

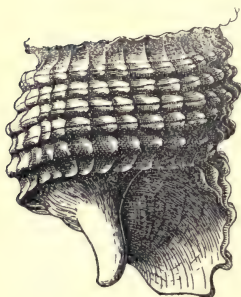


Fig. 26.

Shell tall, slender, thin and translucent. Colour uniform pale amber, except a glassy white topmost whorl. Whorls nine in my example, whose tip is broken. Sculpture—on the earlier whorls proportionately fewer, on the last, six spiral alternately larger and smaller rows of crowded gemmules, which also regularly succeed one another in longitudinal order, being

continued across the suture from whorl to whorl and ascending the spire obliquely. The individual gemmules, as seen in profile are much elevated, seen in full face are oval; those of the upper four rows of the last whorl are impressed and bisected by a shallow transverse groove, invisible in profile, but apparently doubling the transverse rows of gemmules when seen in full face. Above the first and below the fifth row, the longitudinal axis of each continues as a pillar, giving a fluted aspect to the broad and deep sutural excavation. The lowest row is swallowed by the suture of the subsequent whorl. Beneath the sixth row the shell is much undercut and then tapers to the columella. The aperture is nearly square with sharp outer lip, arched columella, and very short perpendicular canal. Length $4\frac{1}{2}$, breadth $1\frac{1}{2}$ mm.

One specimen from the lagoon beach of Funafuti.

This appears to be distinguished from other Pacific *Cerithiopsis* by the more numerous rows of closely packed granules.

TRIFORIS DOLICHA, Watson.

Watson, Chall. Report, Zool., xv., 1886, p. 565, pl. xlii., fig. 1.

One specimen from the Funafuti lagoon agrees exactly with another now before me from Prince of Wales Island, Torres Straits. Young specimens were collected off Cape Sidmouth, Queensland, by Mr. A. U. Henn, and presented to this Museum. The "Challenger" collected it a little west of Cape York.

The two adult specimens I have seen are pure white, punctuated between the gemmules with orange; in neither is the lip more developed than in the "Challenger" example. It may be that this species does not attain the spurred lip of its congeners.

TRIFORIS ÆGLE, Jousseaume.

(Fig. 27)

Jousseaume, Bull. Soc. Mal. France, 1884, p. 256, pl. iv., fig. 12;

Tryon, Man. Conch., ix., 1887, p. 185, pl. xxxix., fig. 40.

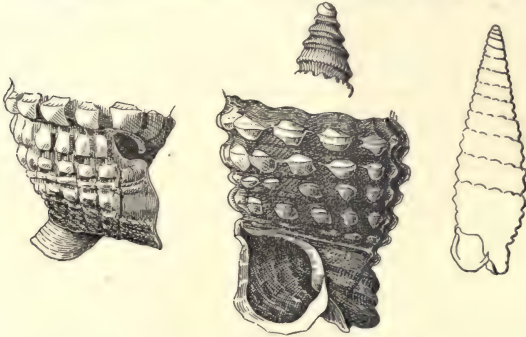


Fig. 27.

Jousseaume's account, as reflected in Tryon's Manual is too scanty to allow of a proper determination, and with much doubt I assign here a Funafuti species. A single specimen of *T. ægle*, from Noumea, presented by Mr. R. C. Rossiter, now before me, is too immature to show the aperture. It is a larger and lighter coloured shell than those from Funafuti, and the gemmules seem rather closer together. As, however, it fairly corresponds to the *Ellice* shells in apex and sculpture, I prefer, instead of adding another name to the long list of *Triforis*, to assume that the one figured and described below is a variety of Jousseaume's species. The still more scanty information published relative to *T. collaris*, Hinds, suggests that it should also be compared.

* Hinds—Proc. Zool. Soc., 1843, p. 23; and Journ. Conch., viii., 1897, p. 409.

Shell rather narrow, tapering to a fine and slender point. Whorls fifteen. Colour ochraceous with white gemmules. Protoconch six whorled, first two together semiglobose and shagreened; remainder keeled by a single, strong, central, projecting carina, which is beaded by the passage of numerous close set delicate bars crossing the whorls obliquely. All adult whorls except the last have two rows of gemmules, about sixteen in a row, alternating vertically. On the last whorl there are two additional anterior rows of smaller gemmules, an incipient row on the periphery and two minor scarcely beaded ridges on the base. The gemmules are large and very prominent, polished and reflecting a nacreous lustre, rounded anteriorly, flattened with corner angles peripherally and shelved atop; each is linked to its neighbours in the row by a coloured ridge; in the centre of the whorl a sharp groove runs between the two rows. The surface in general is decussated by faint growth lines crossing spiral engraved lines. Aperture nearly perpendicular, ovate, inner lip with a thick callus layer, outer lip thickened and reflected, the right margin crossing the canal in a spur; anal notch cordate, the orifice taking the place of the last sutural gemmule, canal oblique, moderately produced. Length 5, breadth $1\frac{1}{4}$ mm.

Shallow water in the lagoon. The commonest *Triforis* at Funafuti.

Prominent characters which distinguish this species are the large, white, faceted, gemmules contrasted against the dark background, the one-keeled apex, and the peculiar anal notch.

TRIFORIS TORQUATUS, sp. nov.

(Fig. 28).

Shell moderately broad. Whorls fifteen, suture sharply impressed. Colour orange buff; on the ninth and tenth whorls the lower rows of gemmules are chocolate, and on the last row two narrow bands of chocolate cover two anterior rows of gemmules, stain the lip and wind down the throat; on the eleventh, twelfth, thirteenth and fourteenth whorls, the lower lines of gemmules are white; the seventh and eighth whorls are entirely white. Protoconch six whorled, first two together semiglobose, remainder keeled by a single, strong, central, projecting carina, which is beaded by coarse, slightly oblique bars. All adult whorls, except the last, have two rows of gemmules, about seventeen to a row, alternating vertically. On the last whorl there is in addition a peripheral and two basal ridges, all scarcely beaded. On the penultimate whorl a thread appears in the space between the gemmules, and follows the sinuations of the upper tier as far as the aperture without gaining equal rank. The gemmules are polished hemispherical bosses, shelved above, distant about half

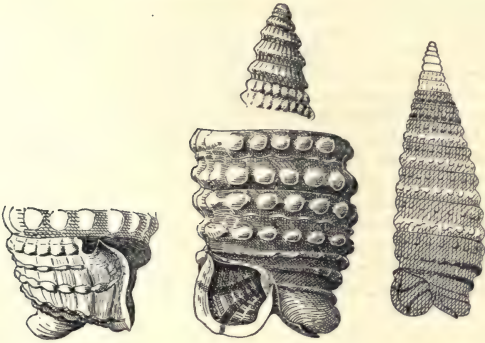


Fig. 28.

their own diameter from their neighbours in a row, and linked to them by an inconspicuous raised coloured ridge. Between the gemmules the surface is microscopically shagreened and finely spirally grooved. The aperture is perpendicular, and nearly square; outer lip thickened and reflected, the right margin crossing the canal in a spur; anal notch deep; semicircular canal short, blunt, oblique. Length 5, breadth 2 mm.

Several specimens alive in the Funafuti lagoon.

The peculiar colouration of this species facilitates recognition. Even the unaided eye can detect the two chocolate lines on the base and spire, and the white spiral band ascending the intermediate whorls. This colour scheme I have endeavoured to convey in Fig. 28.

In colour *T. cinguliferus*, Pease, appears to resemble *torquatus*, but the figure given by Langkavel, copied and coloured by Tryon, represents a stouter shell with a different aperture.

The group (*Mastonia*, according to Tryon) to which this belongs, might be conveniently divided into two sections, having a one-keeled and a two-keeled protoconch, respectively. The present species with *T. dolicha* and *T. ægle* would belong to the former.

I have collected *T. torquatus* also at Port Moresby, British New Guinea.

TRIFORIS RUBER, *Hinds*.

(Fig. 29).

Hinds, Ann. Mag. Nat. Hist., xi., 1843, p. 18.

The species before me is the most abundant, conspicuous and widespread of the genus in the tropical Pacific. If I have

correctly identified it, the shell was first taken by Belcher during the voyage of the "Sulphur." He noticed it at Port Carteret, New Ireland, as "numerous among fine gravel at low water." There are two colour varieties of this shell—one pale, the other dark. Conchological tradition appears universally, but I think erroneously, to regard the dark form as *T. ruber* and the pale as *T. violaceus* of Quoy and Gaimard. For the purpose of specific determination the descriptions of all older writers, and most modern ones, of species of *Triforis* are worthless. The identity of *T. violaceus* must be decided by the illustrations of that species in the "Atlas of the Voyage of the Astrolabe." This shows a slender and produced anterior canal, and an anal notch projecting as a complete tube, remote from the aperture. Specimens answering to these details, which I collected in Milne Bay, British New

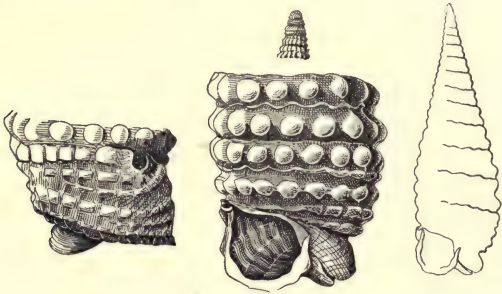


Fig. 29.

Guinea, are before me. Though Quoy and Gaimard may themselves have confounded distinct species, and though Kiener's figure from "Astrolabe" material appears to disagree with the former illustration, yet the only safe point of departure in unravelling the nomenclature of this group must be Figs. 22 and 23 of Pl. lv. of the Atlas aforesaid. In the particulars of the anal and anterior orifices, the shell before me, presumed to be *T. ruber*, differs altogether, as the accompanying drawings show.

In the unsatisfactory state of literature, the following remarks may not be deemed superfluous.

This species varies in size, stoutness, and colour; from the adult an immature shell so differs in outline, that a collector does not at first recognise it as the same kind, for it much resembles *Triforis gemmulatus*, Adams and Reeve.* As a whole the contour of the adult shell resembles that of a carrot, the upper whorls

* Adams & Reeve—Zool. Samarang, 1850, Mollusca, pl. xi., fig. 34 a, b.

tapering to a slender point, the lower swollen to bulbous. Colour, which alters in drying, reddish purple to lilac, the apex and the lower row of gemmules usually cream. Whorls about eighteen. Gemmules subcircular, polished bosses, shelved above, separated by about half their own diameter, in two rows of about twenty-two in a whorl, alternating vertically; the interspaces between the gemmules are spirally wrinkled. On the antipenultimate whorl a spiral thread arises between the two rows of gemmules, but following the sinuations of the upper, this gradually increases, becomes segmented, and on the last whorl forms an additional row of gemmules. Just behind the aperture extra rows are also intercalated. The protoconch is acicular, four or five whorled, the whorls bicarinate, crossed obliquely by numerous fine bars, which bead the carinæ. The aperture is perpendicular, almost square, lip reflected, the right margin crossing the canal in a spur, the canal being closed by its anterior wall folded over, but not touching the pillar. Anal notch deep, a subcircular, subtubular, orifice in the place of the last sutural gemmule; onwards from the last actual gemmule the lip is free from the body whorl. Length $7\frac{1}{2}$ mm.

Common in shallow water in the lagoon of Funafuti. As the rare *T. violaceus* has been generally confounded with the common *T. ruber*, whose aperture is quite different, most literary records are untrustworthy, and I forbear to quote them. I have myself collected the species at Port Moresby and Milne Bay, British New Guinea, and at Oubatche and Noumea, New Caledonia. Specimens of *T. ducosensis*, Jousseume, received from Noumea, from Mr. R. C. Rossiter, belong to the pale form of *T. ruber*.

TRIFORIS CLIO, sp. nov.

(Fig. 30).

Shell rather small and slender. Colour cinnamon-brown, lowest row of gemmules and extremity of canal white, other gemmules pale brown. Whorls fifteen. Protoconch five whorled; first two together swollen and subglobose, shagreened, remainder bicarinate by a median furrow and crossed by numerous fine bars which bead the carinæ. The adult whorls are beset by first two, then three, and finally four spiral rows of gemmules, eighteen to a whorl, set vertically, gemmule above gemmule, up the spire. Broad furrows ascend vertically from whorl to whorl, deeper than the spiral interspaces which part row from row. The gemmules are lozenge shaped, polished, standing half their length apart and linked to their neighbours in a row by a coloured band smoother and shallower than the remainder of the vertical furrow, of which it forms a part. Between the gemmules the surface is roughened by close fine spiral hair lines. Two unbeaded cords run round the base. Aperture nearly vertical, outer lip bending round a

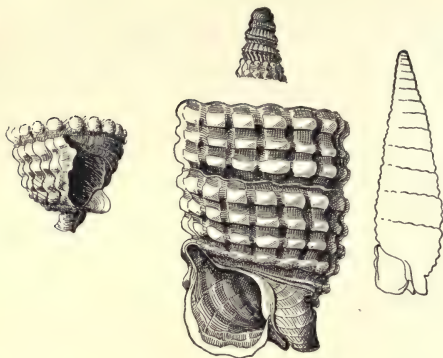


Fig. 30.

shallow rounded anal notch, then deeply emarginate and finally much produced, crossing the pillar in a spur. Canal short and rather sharply recurved. Length $5\frac{1}{2}$, breadth $1\frac{3}{4}$ mm.

Three examples were found in shallow water in the Funafuti lagoon. The most mature, depicted here, is possibly not quite adult and the anal notch may attain a further development.

The lozenge shaped gemmules and the exceptional feature of the longitudinal furrows being deeper than the transverse assist in distinguishing the species.

TRIFORIS OBESULA, Jousseaume.

(Fig. 31).

Jousseaume, Bull. Soc. Mal. France, 1884, p. 255, pl. iv. fig. 17 ;

Tryon, Man. Conch., ix., 1887, p. 185, pl. xxxviii., fig. 27.

Jousseaume's account of this species is not accessible to me and I have to assume that Tryon gives a faithful transcript of it. That however only allows me to identify the shell I now figure and describe as *T. obesula*, with probability rather than certainty. My perplexity is increased by the fact that the Funafuti shell is identical with specimens received from New Caledonia labelled "*T. limosa*, Jousseaume," with the description of which they disagree in shape and size.

The species is distinguished by its small size, corpulent shape and dark brown (burnt umber) hue. The type of sculpture differs from that of the other species of *Triforis* from Funafuti. The gemmules are so closely packed within the row and are so

feebly divided from one another, that they seem rather to be a continuous keel, like that of *T. corrugatus*, in process of breaking down into beads. The earlier adult whorls are ornamented by two bead-rows. Between them there arises in the antipenultimate a thread, which gradually increasing becomes a full grown row in the last whorl; the addition of a median and two basal rows brings the number of rows on the last whorl to six. Tryon states that the "three anterior ones are unarmed," but all are beaded in the example before me.

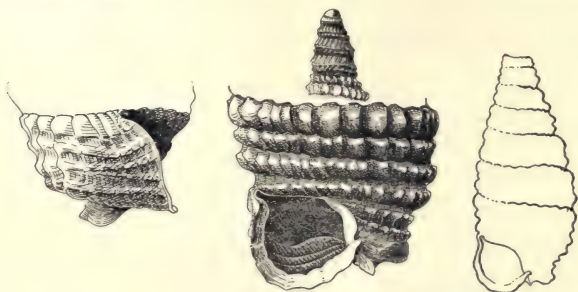


Fig. 31.

The anal notch is simple and comparatively shallow. The protoconch has five whorls, the first hemispherical and smooth, the others bicarinate and obliquely crossed by rather coarse bars which do not bead the carinae. The adult sculpture suddenly commences in the sixth whorl with a row of small beads above and a large gemmed ridge below. The latter is remarkable in several specimens before me for its white colour, giving the shell to the unaided vision a distinct white collar beneath the acicular apex. Tryon gives the length as 8 mm. Of the examples before me the New Caledonian measure $4\frac{1}{2}$, the Papuan 4, and the decollated shells from Funafuti $3\frac{1}{2}$ mm.

Two decollated specimens occurred to me in the Funafuti lagoon. I have also taken the species between tide marks in Port Moresby, British New Guinea. A Papuan specimen supplied the material for the above account of the apex, missing in Funafuti and New Caledonian examples.

TRIFORIS THETIS, sp. nov.

(Fig. 32).

Shell small and slender. Colour uniform cinnamon-brown except a patch of dark chocolate on the columella. Whorls fifteen. Protoconch five whorled, the later three bicarinate,

crossed obliquely by numerous fine bars which bead the carinæ. The adult whorls are beset with two bead-ridges, carrying each about sixteen gemmules of equal size to a whorl, vertically the gemmules run slightly oblique, between each ridge is a deep and narrow groove. In the antipenultimate whorl a thread appears in this groove and ultimately grows on the last whorl to a gemmule row. A raised thread beneath the suture ascends for a few whorls. The last whorl is ornamented by this thread followed by a row of large gemmules, two rows of smaller ones, an incipient peripheral row and two minor, basal, subnodulose ridges. The gemmules are coloured, polished, hemispherical, truncated and shelved above, and stand nearly their diameter apart on the ridge.

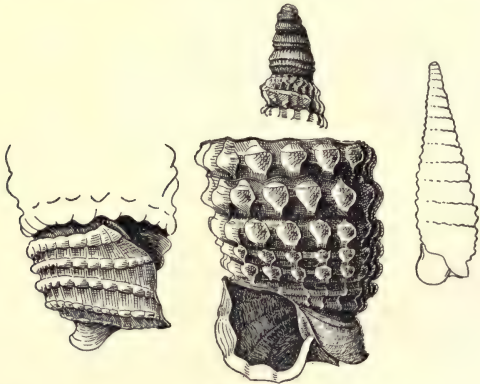


Fig. 32.

The suture is deep and well defined. Between the gemmules the surface is roughened by minute spiral threads cut by oblique growth lines. Aperture vertical, nearly square. Outer lip crossing the pillar in a spur. Anal notch a simple open fold. Canal short and briefly recurved. Length 4, breadth 1 mm.

Shallow water in the Funafuti lagoon, several specimens.

Seeing that Tryon, whose standard of description was not severe, concludes his monograph of the genus with a list of eighty unrecognizable *Triforis*, I have no confidence that the species above described has not previously appeared in literature, though I am sure that it has never been properly characterised. It is probably near, and possibly identical with, *T. limosa*, Jousseaume. That writer (as repeated by Tyron) neglects the important details of apex, anal notch, etc., and the fact that the Funafuti shells are but

half its size, has decided me, in the absence of other information to regard it as distinct. A shell from Port Moresby closely resembles the Ellice one, differing by larger size and more swollen contour.

TRIFORIS INCISUS, Pease.

(Fig. 33).

Tryon, *loc. cit.*, p. 190, pl. xxxix., fig. 65.

The inadequate description and poor figure quoted, suggest, but fail to demonstrate, that a shell figured herewith should be so named. The species is represented by a single, perforated and decollated example from the Funafuti lagoon. It is $5\frac{1}{2}$ mm. in length, has thirteen whorls remaining, and in colour is ochraceous splashed with white. The last whorl has six spiral ridges, two of which are basal; the three preceding whorls have each three, and those above each two such ridges. The ridges are smooth, elevate and keeled, the anterior of each series the larger; on the upper

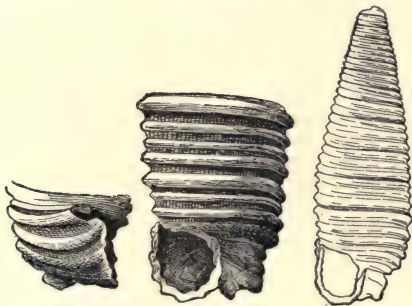


Fig. 33.

whorls the posterior ridge tends to divide into beads. The interstices are broad, deep and finely spirally grooved. The spur of the outer lip crosses the pillar. Anal notch deep and cordate. Canal short and perpendicular.

Pease described *T. incisus* from Hawaii.* I have collected at Port Moresby, British New Guinea, what seems a form of that described above. It differs in colour being variegated with black, chocolate and white. The uppermost ridge has not the same disposition to become beaded but longitudinal plications are developed in the interstices. The protoconch in these Papuan shells is six whorled, bicarinate and crossed by coarse bars, like the apex I figure for *T. obesula*.

* Pease—Proc. Zool. Soc., 1860, p. 434.

TRIFORIS CORRUGATUS, *Hinds*.

Hinds, Ann. Mag. Nat. Hist., xi., 1843, p. 18; Hinds, Voy. "Sulphur," Zool., pl. viii., fig. 12; Chenu., Man. Conch., 1859, p. 284, figs. 1915, 1916; Langkavel, Donum Bismarckianum, 1871, p. 26, pl. ii., fig. 6; Tryon, Man. Conch., ix., 1887, p. 189, pl. xxxix., fig. 59.

T. connatum, Montrouzier, Journ. Conch., x., 1862, p. 236, pl. ix., fig. 4.

A considerable series of specimens from various localities and a careful examination of the literature quoted, enable me to confidently unite Montrouzier's species with that of Hinds. It should be obvious to any student who compares the excellent figure in the Journal de Conchyliologie with the other illustrations that the immaturity of the New Caledonian example is the only point of difference. That this synonymy of so common and distinct a species should have so long escaped attention is another sad proof of the negligence of the authors who have dealt with this much abused genus. Reviewing the shells of Lifu, Melvill and Standen actually record the species first under one name and then under the other.* Tryon has suggested *T. bayani*, Jousseaume, as a probable synonym, an idea which his figures seem to contradict. One of the specimens before me shows the protoconch to have a double keel, with a very narrow interstice.

The shallow water of the Funafuti lagoon yielded me several broken specimens. A wide range over the Pacific is indicated by the following records:—New Guinea (Belcher); Queensland, Torres Straits, (Brazier)† and Cape Sidmouth, (Henn); Gilbert Islands (Garrett); New Caledonia, Ile Art (Montrouzier); Oubatche and Noumea (Hedley); and Lifu (Hadfield).

TRIFORIS, spp.

Several other species of *Triforis*, too worn for identification or determination are included in the collection.

OVULA HERVIERI, sp. nov.

(Fig 34).

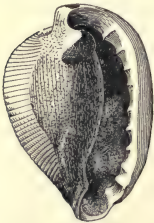


Fig. 34.

Shell small, broadly ovate. Colour pale yellow with four spiral bands of rose, visible alike within the aperture, across the callus and on the dorsal surface, these bands are in breadth equal to their interstices. Sculpture—about thirty-five flat-topped spiral lyrae, separated by narrow, sharply incised grooves, surround the shell. The outer lip is much thickened and reflected without, and bears within about ten slight and widely parted

* Melvill & Standen, *loc. cit.*, viii., pp. 114 and 409.

† Brazier—Proc. Linn. Soc. N.S.W., i., 1876, p. 319.

denticules. The callus on the inner lip is very heavy, its surface shagreened, posteriorly it rises into an abrupt boss and anteriorly is heaped in a longitudinal ridge. Length 4, breadth 3 mm.

Taken alive from the deep water Gorgonidæ raised from the western slope of Funafuti in eighty to forty fathoms.

This very distinct little species, the smallest of its genus known, appears to find its nearest relation in *Ovula caledonica*, Crosse;* from which it is easily separated by smaller size, greater proportional breadth, coarser sculpture and fewer labial denticules.

It is named in compliment to the Rev. J. Hervier, the author of many clear descriptions and admirable drawings of Pacific shells.

CYPÆA ARGUS, Linne.

Tryon, Man. Conch., vii., 1885, p. 164, pl. i., figs. 1, 2; Garrett, Journ. Conch., ii., 1879, pp. 106, 109.

Dead shells were found on the beach of one of the western islets of Funafuti, and the species was again encountered at Nukulailai.

According to Garrett, this deep water species inhabits the Carolines, Gilberts, Tonga, Fiji and Samoa. Rossiter records it from New Caledonia, the Isle of Pines and the Loyalties.† From material in this Museum I add the Solomons, Erromanga and Aneiteum, New Hebrides.

CYPRÆA SCURRA, Chemnitz.

Tryon, *loc. cit.*, p. 165, pl. ii., figs. 19, 20, 21; Garrett, *loc. cit.*, pp. 107, 118.

One dead shell was taken on Funafuti.

Tryon quotes it from Anaa, Paumotus. Garrett found this in Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus, Marquesas, and Hawaii. A series in this Museum include instances from the Gilberts, the Louisiades, Woodlark Island, New Caledonia and Broken Bay, N. S. Wales.

CYPRÆA TESTUDINARIA, Linne.

Tryon, *loc. cit.*, p. 165, pl. i., figs. 9, 10; Garrett, *loc. cit.*, pp. 107, 119.

Mr. G. Sweet procured an example of this on Funafuti.

Garrett, enumerates this from Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's and Society. Tryon mentions it from New Caledonia. In this Museum it is shown from Niue, the Solomons and Erromanga, New Hebrides.

* Crosse—Journ. de Conch., xx., 1872, p. 62, pl. ii., fig. 1.

† Rossiter—Proc. Linn. Soc. N.S.W., vi., 1882, p. 817.

CYPRÆA ISABELLA, Linne.

Tryon, *loc. cit.*, p. 165, pl. i., figs. 6, 7; Garrett, *loc. cit.*, pp. 106, 114.

Dead shells were plentiful on the Funafuti beach.

The range through Polynesia as given by Garrett, is the same as that of *C. scurra*. The collection of this Museum shows the species to occur along the Australian coast south to the Bellenger River, N.S. Wales, and in the Central Pacific from Niue, Woodlark Island, British New Guinea, Erromanga, and Aneiteum, New Hebrides, New Caledonia and the Gilberts to Hawaii.

CYPRÆA CARNEOLA, Linne.

Tryon, *loc. cit.*, p. 166, pl. iii., figs. 26 – 30; Garrett, *loc. cit.*, pp. 106, 110.

Though I saw none alive, dead specimens were plentiful on the beach of the Funafuti lagoon.

Found by Garrett to accompany the foregoing through the ten archipelagoes enumerated; and seen by Rossiter from New Caledonia, Loyalty Islands, and Isle of Pines.

This species ranges along the Australian coast south to Sydney. Specimens in this Museum show it from the Solomons.

C. CARNEOLA, var. PROPINQUA, Garrett.

Garrett, Journ. Conch., ii., 1879, p. 116.

Two specimens are referable to this variety, which is also represented in the Australian Museum from Niue, the Society and Gilbert Groups. Garrett records it from the Paumotus.

CYPRÆA TALPA, Linne.

Tryon, *loc. cit.*, p. 167, pl. iii., figs. 31 – 33; Garrett, *loc. cit.*, pp. 107, 119.

One empty shell was found at Funafuti with *C. argus*.

Garrett collected this deep-water species at Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus, and Hawaii. It is shown in this Museum to occur in British New Guinea, the Solomons, Erromanga, New Hebrides, New Caledonia, and Niue.

CYPRÆA GOODALLI, Gray.

Tryon, *loc. cit.*, p. 168, pl. iv., figs. 43, 44; Garrett, *loc. cit.*, pp. 106.

Mr. G. Sweet found one well preserved example at Funafuti. Garrett only knew this from Cook's, Society, and Paumotus. There are specimens in this Museum from the Gilberts.

CYPRÆA FIMBRIATA, Gmelin.

Tryon, *loc. cit.*, p. 168, pl. v., figs. 76 – 78; Garrett, *loc. cit.*, pp. 106, 112.

Dead shells were noticed at Funafuti and at Nukulailai.

Garrett observed this from the same Groups as *C. talpa*. This species ranges along the Australian coast south to Sydney. Museum specimens include it from Milne Bay, British New Guinea, New Caledonia, Niue, the Gilberts, and Hawaii. Tryon quotes it from the Paumotus.

CYPRÆA MACULA, Adams.

Tryon, *loc. cit.*, p. 169, pl. iv., figs. 71, 72.

Mr. G. Sweet obtained one specimen.

CYPRÆA MAURITIANA, Linne.

Tryon, *loc. cit.*, p. 173, pl. vii., figs. 8 – 11.

Specimens of this were purchased from the natives of Funafuti.

Collected by Garrett at Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus, Marquesas, and Hawaii, and by Rossiter in New Caledonia and the Loyalties. Weinkauff mentions it from the Pelew Islands. I have seen it from the British and German Boundary, N.E. New Guinea. In this Museum it is also represented from Aneiteum and Erromanga, New Hebrides, and Niue.

CYPRÆA CAPUT-SERPENTIS, Linne.

Tryon, *loc. cit.*, p. 173, pl. vi., figs. 98 – 100, xxiii., fig. 59; Garrett, *loc. cit.*, pp. 106, 111.

Commonly found alive under stones in shallow water in the Funafuti lagoon.

Seen by Garrett in Fiji, Tonga, Samoa, Gilberts, Carolines, Cooks, Society, Paumotus and Marquesas. This extends along the Australian coast south to Sydney, and is also represented in this Museum from Erromanga, New Caledonia, Lord Howe Island, Niue, and the Gilberts. The natives of Funafuti call this "pourei."

CYPRÆA MAPPA, Linne.

Tryon, *loc. cit.*, p. 174, pl. vii., figs. 12 – 14; pl. viii., fig. 17; Garrett, *loc. cit.*, pp. 106, 115.

Mr. G. Sweet procured one dead specimen of this.

According to Garrett the range embraces Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, and Paumotus. It is in this Museum from the Louisiades. Tryon quotes New Caledonia.

CYPRÆA ARABICA, Linne.

Tryon, *loc. cit.*, p. 174, pl. viii., figs. 18, 19, 23, 24; Garrett, *loc. cit.*, pp. 106, 108.

Occasionally found alive under coral blocks in the Funafuti lagoon.

Garrett noticed this in Fiji, Tonga, Samoa, Gilberts, Carolines, Society and Paumotus. Brazier* has remarked it from Torres Straits southwards to Botany Bay, from Fiji, New Britain, New Ireland, New Caledonia and the Solomons. It is further represented in this Museum from Woodlark Island (British New Guinea), Erromanga and Aneiteum (New Hebrides), and Niue.

CYPRÆA RETICULATA, *Martyn.*

Tryon, *loc. cit.*, p. 174, pl. viii., figs. 20 – 22 ; Garrett, *loc. cit.*, pp. 107, 117.

A small variety occurs alive in the Funafuti lagoon.

Garrett saw this in the Gilberts, Cooks, Society, Paumotus, Marquesas and Hawaii.

CYPRÆA MONETA, *Linne.*

Tryon, *loc. cit.*, p. 177, pl. x., fig. 46 ; pl. xi., figs. 51 – 54 ; pl. xxiii., figs. 60 – 69 ; Garrett, *loc. cit.*, pp. 106, 115.

Abundant alive under stones round the margin of the Funafuti lagoon.

Garrett records it from Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus, Marquesas, and Hawaii. This species ranges along the Australian coast from Torres Straits south to Sydney.† I have seen it at Milne Bay and Port Moresby, British New Guinea. In this Museum are examples from Niue, Teste Island, Louisiades, the Solomons, Erromanga, New Hebrides, New Caledonia, and Lord Howe Island. "At Eramanga," writes Brenchley,‡ "a shell called '*Nunpuri*,' the *Cypræa moneta*, passes as money, as also in New Caledonia."

CYPRÆA MONETA, var. ANNULUS, *Linne.*

Occurred as usual in company with the species in chief, with which, like *C. obvelata*, and contrary to the opinion of monographers, it intergrades by easy stages.

CYPRÆA TIGRIS, *Linne.*

Tryon, *loc. cit.*, p. 180, pl. xi., figs. 49, 50 ; pl. xv., fig. 8 ; Garrett, *loc. cit.*, pp. 107, 120.

I picked up one broken shell on the beach of Funafuti, and purchased a specimen from a native on Nukulailai.

Seen by Garrett from Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus, Marquesas, and Hawaii. This occurs

* Brazier—*Journ. Conch.* ii., 1879, p. 194.

† Henn—*Proc. Linn. Soc. N.S.W.* (2), x., 1895, p. 520.

‡ Brenchley—*The Cruise of the "Curaçoa,"* 1873, p. 299.

along the Australian coast as far south as Moreton Bay.* Melvill and Standen name it from Lifu. In this Museum it is shown from Woodlark Island, Solomons, and Erromanga, New Hebrides. I have seen it at Port Moresby, British New Guinea, where the natives call it "nononono."

CYPRÆA VITELLUS, Linne.

Tryon, *loc. cit.*, p. 182, pl. xiii., figs. 72, 73; Garrett, *loc. cit.*, pp. 106, 121.

One specimen was obtained at Funafuti by Mr. Sweet.

Garrett took this species at Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus, Marquesas, and Hawaii. It ranges along the Australian coast south to Sydney. Further instances from Niue, the Louisiades, New Caledonia, and Erromanga, are supplied by this Museum.

CYPRÆA LYNX, Linne.

Tryon, *loc. cit.*, p. 183, pl. xiv., figs. 86, 87, 98; Garrett, *loc. cit.*, pp. 106, 114.

Found alive under stones in the Funafuti lagoon.

Except the Marquesas, this species, says Garrett, ranges all through Polynesia. It inhabits the Australian coast south to Moreton Bay. The collection of this Museum exhibits it from Erromanga, New Hebrides, New Caledonia, Fiji, and the Gilberts.

CYPRÆA CLANDESTINA, var. ARTUFFELI, Jousseaume.

Melvill & Standen, *Journ. Conch.*, viii., 1896, p. 112, pl. iii., figs. 28, 29.

Alive in the lagoon of Funafuti. Previously reported from Lifu.

CYPRÆA CRIBRARIA, Linne.

Tryon, *loc. cit.*, p. 190, pl. xvii., figs. 71, 72.

I did not find this species, which has been recorded from the Ellice by Schmeltz.

CYPRÆA EROSA, Linne.

Tryon, *loc. cit.*, p. 192, pl. xviii., figs. 1, 90, 100; Garrett, *loc. cit.*, pp. 106, 111.

Mr. G. Sweet brought a specimen from Funafuti. Garrett observed that, except at the Marquesas, it was not uncommon at all the groups he visited. It ranges along the Australian coast south to Broken Bay. A specimen from Erromanga, New Hebrides, is now before me.

* Brazier—*Proc. Linn. Soc. N.S.W.*, v., 1881, p. 501.

CYPRÆA PORARIA, *Linne.*

Tryon, *loc. cit.*, p. 193, pl. xviii., figs. 2, 3; Garrett, *loc. cit.*, pp. 107, 116.

A few dead shells were obtained from the beaches of Funafuti.

Garrett obtained this at Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus, and Hawaii. Rossiter records it from New Caledonia and the Loyalty Islands.

CYPRÆA HELVOLA, *Linne.*

Tryon, *loc. cit.*, p. 194, pl. xix., figs. 8, 9; Garrett, *loc. cit.*, pp. 106, 113.

I found one alive under a coral boulder on the western side of the Funafuti lagoon.

Garrett collected this at Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus, Marquesas, and Hawaii. Rossiter gives it from New Caledonia, Loyalty, and Isle of Pines. This extends south along the Australian coast as far as Sydney.

CYPRÆA CICERCULA, *Linne.*

Tryon, *loc. cit.*, p. 197, pl. xx., figs. 55 - 58, 61, 62; Garrett, *loc. cit.*, pp. 107, 122.

Several empty shells from the beach drift of Funafuti.

Noted by Garrett from Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus, and Hawaii; and by Rossiter from New Caledonia and the Loyalty. In this Museum it is also shown from Niue, Torres Straits, and Aneiteum, New Hebrides.

CYPRÆA NUCLEUS, *Linne.*

Tryon, *loc. cit.*, p. 197, pl. xx., figs. 48, 49; Garrett, *loc. cit.*, pp. 107, 125.

Frequently seen dead on the Funafuti beach.

Observed by Garrett at Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus, and Hawaii. Rossiter reports it from the Loyalty. There are specimens in this Museum from the Solomons and New Hebrides.

CYPRÆA CHILDRENI, *Gray.*

Tryon, *loc. cit.*, p. 198, pl. xx., figs. 53, 54; Garrett, *loc. cit.*, pp. 107, 122.

Mr. G. Sweet found one of this at Funafuti.

Garrett reports it from Fiji, Tonga, Samoa, Gilberts, Cook's, Society, and Paumotus. Specimens from New Caledonia, Niue, and Hawaii are in this Museum.

TRIVIA ORYZA, *Lamarck*.

Tryon, *loc. cit.*, p. 200, pl. xxi., figs. 79, 82, 83 ; Garrett, *loc. cit.*, pp. 107, 126.

Several dead specimens of a small form of this species were collected on the beach of the Funafuti lagoon.

This ranges along the Australian coast as far south as Sydney. Garrett remarks that this has the same range and station in Polynesia as the preceding species. Rossiter notes it from Noumea, New Caledonia, and the Loyalty. It is shown in this Museum from the New Hebrides.

DOLIUM PERDIX, *Linne*.

Tryon, *loc. cit.*, p. 264, pl. iii., fig. 15 ; pl. iv., figs. 23 – 25.

I was unable to obtain an example of this circumæquatorial species on Funafuti, but I identified one purchased from a native by another member of our party.

Melvill and Standen note this from Lifu. This Museum has representatives from British New Guinea, the Solomons, Erromanga, New Hebrides, New Caledonia, the Gilberts, and Niue.

DOLIUM POMUM, *Linne*.

Tryon, *loc. cit.*, p. 265, pl. v., fig. 26.

One specimen from the lagoon beach.

Tryon quotes this from the Society Islands. Material in this Museum indicates it from British New Guinea, New Caledonia, and the Gilberts.

CASSIS CORNUTA, *Linne*.

Tryon, *loc. cit.*, p. 270, pl. i., figs. 45, 46 ; pl. ii., fig. 49.

I collected no examples of this personally, but at Funafuti I remarked it in use as shell trumpets, and at Nukulailai I purchased specimens. There the natives called it "pou," and told me it was not rare. New Caledonian examples are contained in this Museum.

CASSIS VIBEX, var. ERINACEA, *Linne*.

Tryon, *loc. cit.*, p. 277, pl. vii., fig. 90.

Two dead shells from the lagoon beach.

TRITONIUM TRITONIS, *Linne*.

Tryon, *Man. Conch.*, iii., 1881, p. 9, pl. i., fig. 1 ; pl. iii., fig. 16 ; pl. iv., fig. 25.

I did not myself collect this species. Mr. J. O'Brien told me that it was sometimes found on the leeward reefs alive. The natives recognised an engraving of it as "bofala."

TRITONIUM PILEARE, *Linne.*

Tryon, *loc. cit.*, p. 12, pl. vi., figs. 31 – 36; pl. vii., figs. 38, 39.

A few were found alive in the lagoon. Tryon indicates the range of this species as circumæquatorial. Its occurrence in every archipelago in the Pacific is therefore to be expected.

TRITONIUM CHLOROSTOMUM, *Lamarck.*

Tryon, *loc. cit.*, p. 13, pl. vii., figs. 47, 48.

One empty shell from the lagoon beach of Funafuti. This species appears to share the geographical range of its predecessor.

TRITONIUM GEMMATUM, *Reeve.*

Tryon, *loc. cit.*, p. 13, pl. vii., figs. 41 – 44.

A single specimen was taken on Funafuti.

Tryon cites this from the Paumotus, and Melvill and Standen from Lifu. Representatives from New Caledonia and Fanning Island are in this Museum.

TRITONIUM DIGITALE, *Reeve.*

Tryon, *loc. cit.*, p. 29, pl. xv., figs. 142, 143.

Common alive in the Funafuti lagoon.

Tryon gives Fiji, and Smith* Strong Island, as localities. In this Museum it is exhibited from San Christoval, Solomons, Aneiteum, New Hebrides, Marquesas, and Hawaii.

TRITONIUM TUBEROSUM, *Lamarck.*

Tryon, *loc. cit.*, p. 23, pl. xiii., figs. 111 – 113.

One specimen, alive, from the Funafuti lagoon.

From Lifu, Melvill and Standen note this species; and examples from Woodlark Island and Port Moresby, British New Guinea, repose in this Museum.

TRITONIUM MACULOSUM, *Gmelin.*

Tryon, *loc. cit.*, p. 25, pl. xiv., fig. 121.

One dead shell was found on a western islet of Funafuti. This Museum has the species from the Gilberts.

DISTORTRIX ANUS, *Linne.*

Tryon, *loc. cit.*, p. 35, pl. xv., fig. 153; pl. xvii., figs. 173, 174.

I did not find this species on Funafuti, but have seen specimens collected there by Mr. G. Sweet.

* Smith—Journ. Linn. Soc., Zool., xii., 1876, p. 551.

Tryon mentions it from the Society Islands. Examples from the Solomons are contained in this Museum.

GYRINEUM BUFONIUM, Gmelin.

Tryon, *loc. cit.*, p. 39, pl. xxi., figs. 21 - 23, 28, 29, 68; pl. xix., fig. 11; pl. xx., figs. 13, 14.

Several were found alive under stones in shallow water in the Funafuti lagoon.

Inhabits the Paumotus, according to Tryon, and is shown in this Museum from Torres Straits, Solomons, and New Caledonia.

GYRINEUM AFFINE, Broderip.

Tryon, *loc. cit.*, p. 42, pl. xxii., figs. 38 - 41; pl. xxiii., fig. 55.

An empty shell was found on the lagoon beach of Funafuti.

Tryon notes it from New Caledonia, Samoa, and Paumotus. *G. graniferum*, Lamarck, has been recorded from the Ellice by Schmeltz.

PERISTERIA NASSATULA, Lamarck.

Tryon, *loc. cit.*, p. 80, pl. lxiv., figs. 44 - 47, 51, 52, 58.

Abundant in the rock-pools of the outer reef of Funafuti.

Tryon quotes this from New Guinea, New Caledonia, and the Paumotus; and Schmeltz from Upolu and Rarotonga.

LATIRUS POLYGONUS, var. BARCLAYI, Reeve.

Tryon, *loc. cit.*, p. 88, pl. lxvii., fig. 110.

A few dead shells from the beach of the Funafuti lagoon.

Schmeltz records this from Fiji.

LATIRUS CRATICULATUS, Linne.

Tryon, *loc. cit.*, p. 93, pl. lxix., fig. 159.

Not common; a few dead shells seen on the lagoon beach of Funafuti.

Schmeltz mentions it from Upolu and Rarotonga. Specimens from New Caledonia are in this Museum.

PISANIA FASCICULATA, Reeve.

Tryon, *loc. cit.*, p. 146, pl. lxxi., figs. 195, 197.

Recorded by Schmeltz from the Ellice.

CANTHARUS UNDOSUS, Linne.

Tryon, *loc. cit.*, p. 162, pl. lxxiv., figs. 280 - 282.

Living specimens were taken in the lagoon of Funafuti.

Represented in this Museum from Port Curtis, Queensland, and New Caledonia.

MUREX ADUSTUS, Lamarck.

Tryon, Man. Conch., ii., 1880, p. 90, pl. xv., figs. 148, 149; pl. xxiv., figs. 210–212; pl. xxv., fig. 217.

Common in shallow water in the lagoon of Funafuti.

Noted from Lifu by Melvill and Standen, and represented in this Museum from New Caledonia.

MUREX FUNAFUTIENSIS, sp. nov.

(Fig. 35).



Fig. 35.

Shell small, biconical. Colour ochraceous buff, banded with chocolate, interior of aperture pale lilac. Whorls seven, sculptured each with seven prominent varices, which mount the spire continuously and obliquely. On the spire each varix presents a hollow spine above a blunt tubercle. Between and parallel to the varices are a series of imbricating lamellæ. Five spiral ridges run round the shoulder of the shell, and undulate both the blades and the interstices of the varices. The lamellæ are likewise microscopically beaded by minute spiral threads. The aperture is oblique, ovate, choked by an inner tuberculate ridge, and by the great development of the columella; the latter is arched, deeply obliquely enter-

ing, anteriorly with two incipient tubercles, and truncate below. Canal short, open, and recurved; above it are two series of disused canals, corresponding to the ultimate and penultimate varices. Length 9, breadth 5 mm.

One specimen, taken by tangles, at a depth of forty to eighty fathoms, on the western slope of Funafuti.

This species approaches nearest to *Murex nuclea*, Reeve,* which it resembles both in colour and form. Judging from his account of that species, it differs by being just half the size, by having seven whorls instead of five, with seven varices apiece instead of six, and especially by being longer in proportion to breadth than the Philippine shell is. Whether these differences are constant or not I cannot say.

* Reeve—Conch. Icon. iii., 1845, *Murex*, pl. xxix., sp. 131.

MUREX RADULA, sp. nov.

(Fig. 36).

Shell small, fusiform. Colour cream, spines orange, columella pale lilac. Whorls seven. Sculpture—eight feeble varices alternating on each whorl. On the third and fourth whorls they are proportionately much stronger and are angled at the periphery. The body whorl has eleven spiral cords, narrower than their interstices; both are over-ridden by fine lamellæ in the line of growth. At frequent intervals these cords produce small, short, tubular, orange spines, which lend a conspicuous and recognizable aspect to the shell. Apex of three whorls conical, smooth, and glossy. Aperture simple, lip sharp, canal broad and open. Length 9, breadth 4 mm.



Fig. 36.

A single specimen, taken at a depth of forty to eighty fathoms with the preceding. This specimen is perhaps immature, but differs so much from any with which I am acquainted as to be considered worthy of description.

PURPURA HIPPOCASTANEUM, Lamarck.

Tryon, *loc. cit.*, p. 162, pl. xlv., figs. 36–43; pl. xlv., fig. 45.

Abundant on the outer reef of Funafuti. Tryon quotes this from the Paumotu, and Melvill and Standen from the Loyalty. In this Museum are instances from Queensland, Fiji, and the Solomons. Both Cooke* and Smith† condemn the treatment of the species in the reference quoted above, but, unfortunately for puzzled students, both think it “needless to discuss the matter at length.”

The species seems to me to stand nearer *Sistrum* than *Purpura*. The natives called this “matapoto.”

PURPURA ARMIGERA, Chemnitz.

Tryon, *loc. cit.*, p. 163, pl. xlv., figs. 50, 51.

Abundant on the outer reef of Funafuti, where its massive shell enables it to withstand the heaviest surf. In aged specimens the projecting points are worn down to the stump.

* Cooke—Journ. Conch., v., 1888, p. 323.

† Smith—Proc. Zool. Soc., 1891, p. 408.

Tryon quotes this from the Paumotus, and Schmeltz from Bowen (Queensland). It is in this Museum from New Caledonia and British New Guinea.

JOPAS SERTUM, *Bruguère*.

Tryon, *loc. cit.*, p. 180, pl. lv., figs. 181, 188 – 190; Pease, *Am. Journ. Conch.*, iv., 1868, p. 117.

A few dead shells were collected on the beach of the Funafuti lagoon.

Tryon quotes this from the Paumotus; Melvill and Standen from Lifu. In this Museum it is represented from Woodlark Island, British New Guinea, the Solomons, Santa Cruz, New Caledonia, and Hawaii.

SISTRUM HYSTRIX, *Linne*.

Tryon, *loc. cit.*, p. 183, pl. lvi., fig. 195.

Common in the rock pools of the outer reef of Funafuti.

Tryon notes this from Hawaii, Fiji, and Paumotus, and Schmeltz from Upolu and Rarotonga. It is in this Museum from New Caledonia.

SISTRUM HORRIDUM, *Lamarck*.

Tryon, *loc. cit.*, p. 184, pl. lvi., figs. 201, 202.

Abundant in the rock pools of the outer reef of Funafuti.

Tryon mentions this from Hawaii, and Melvill and Standen from the Loyalty. It is in this Museum from Samoa.

SISTRUM RICINUS, *Linne*.

Tryon, *loc. cit.*, p. 184, pl. lvi., fig. 200; pl. lvii., figs. 204, 206, 212.

Abundant in the rock pools of the outer reef of Funafuti.

Melvill and Standen record this from Lifu. Specimens from Woodlark Island, British New Guinea, and Hawaii, are included in this Museum.

SISTRUM MORUS, *Lamarck*.

Tryon, *loc. cit.*, p. 185, pl. lvii., figs. 213, 214.

One specimen from the Funafuti lagoon.

In this Museum from the New Hebrides, New Caledonia, Lord Howe Island, Niue, and Tahiti.

SISTRUM DIGITATUM, *Lamarck*.

Tryon, *loc. cit.*, p. 185, pl. lvi., fig. 191; pl. lvii., fig. 203.

Occurred with the preceding, but uncommon.

Melvill and Standen enumerate this from Lifu. It is represented in this Museum from Woodlark Island and New Caledonia.

SISTRUM TUBERCULATUM, Blainville.

Tryon, *loc. cit.*, p. 186, pl. lvii., figs. 218, 220.

Abundant in rock pools on the outer reef of Funafuti.

According to Tryon this inhabits Hawaii. Schmeltz mentions Rockhampton (Queensland), Samoa and Fiji. In this Museum it is shown from New Caledonia and Lord Howe Island.

SISTRUM CANCELLATUM, Quoy.

Tryon, *loc. cit.*, p. 188, pl. lviii., figs. 242, 250.

Common in the rock pools of Funafuti.

Tryon mentions this from Hawaii; Schmeltz gives Fiji, Rarotonga, and Tahiti. A specimen from Fanning Island is contained in this Museum.

SISTRUM FISCELLUM, Chemnitz.

Tryon, *loc. cit.*, p. 188, pl. lviii., figs. 251–257.

Not uncommon on the Funafuti beaches.

Examples from Teste Island, Louisiades, New Caledonia, and Hawaii are preserved in this Museum.

CORALLIOPHILA CORONATA, Barclay.

Tryon, *loc. cit.*, p. 210, pl. lxvi., figs. 372, 373.

One worn specimen was gathered on the beach of Funafuti.

Melvill and Standen, who received this from Lifu, were the first to record it from the Pacific.

GALEROPSIS MADREPORARUM, Sowerby.

Tryon, *loc. cit.*, p. 212, pl. lxvii., figs. 389–391, 398; Pease, *Am. Journ. Conch.* iv., 1868, p. 112.

Purpura porphyroleuca, Crosse, *Journ. de Conch.* xix., 1871, p. 322, pl. xiii., fig. 7.

This species was found alive at Funafuti in crevices of living coral, particularly *Millepora*.

Quoy and Gaimard report this from Tonga, Marie from Tahiti, Gould from Wake Island and Samoa, and Melvill and Standen from Lifu. It is also shown in this Museum from New Caledonia, Hawaii, and Vate, New Hebrides.

The description above quoted by Crosse corresponds so well to Sowerby's, that his name may safely be reduced to synonymy.

MAGILUS ANTIQUUS, Lamarck.

Tryon, *loc. cit.*, p. 216, pl. lxviii., figs. 400–411.

Two young shells were obtained alive in company with the *Galeropsis* just mentioned. Tryon's remark "that all the species that have been differentiated from *M. antiquus* must be regarded with suspicion," has guided my determination. Nothing seems to be recorded of the distribution of this species in the Central Pacific. A specimen from the Solomon Islands is in this Museum.

NASSA SEMITEXTA, sp. nov.

(Fig. 37).

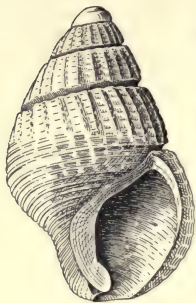


Fig. 37.

Shell broadly ovate, small, strong, opaque, white. Whorls five, of which two are apical and smooth. Remainder sculptured by small, regularly spaced, longitudinal ribs; on the last whorl these number twenty-three and vanish below the periphery. Similar spiral ribs, crossing the longitudinals, lattice the upper whorls and the upper third of the last whorl; on the penultimate there are six of these, and on the last whorl about twenty-five, which are strong and widely spaced on the periphery, weak and crowded anteriorly. A deep and narrow groove follows the suture. Aperture oblique, oval, fortified without by a thick and prominent varix, which is crossed by the spiral sculpture; columella

arched, spreading a heavy sheet of callus, anteriorly incurved and terminating in a rounded knob; canal open, short, in section C-shaped. Length 6, breadth $4\frac{1}{2}$ mm.

A rather worn specimen was found on the lagoon beach by myself, and another was taken by Mr. G. Sweet.

This species is referred to *Nassa* for the unsatisfactory reason that I do not know where else to locate it, and yet the material before me is hardly sufficient foundation for the erection of a new genus. A tubercle near the posterior angle of the aperture is characteristic of *Nassa*, but absent here; while the channelled suture and heavy varix developed here may not be matched in *Nassa*. Indeed, though the contour and anterior notch repel the idea, some aspects of this shell suggest *Rissoina*. Till further data, and the soft parts arrive, the true systematic position of this shell must, I think, remain in suspense.

NASSA GRANIFERA, *Kiener*.

Tryon, Man. Conch., iv., 1882, p. 26, pl. viii., figs. 39 - 41.

Mr. G. Sweet collected one specimen. Melvill and Standen report this from the Loyalty, and the Museum contains it from the New Hebrides.

COLUMBELLA VARIANS, *Sowerby*.

Tryon, Man. Conch., v., 1883, p. 110, pl. xlv., figs. 1, 2, 97 - 100; pl. xlv., figs. 3 - 6.

Common alive in the lagoon of Funafuti.

Tryon mentions it from New Guinea, Fiji, Hawaii, and Galapagos. In this Museum it is shown from Niue, Baker's Island and New Caledonia.

COLUMBELLA GALAXIAS, *Reeve*.

Reeve, Conch. Icon., xi., 1859, *Columbella*, pl. xxxv., sp. 229.

A variable species, plentiful at Funafuti, as also throughout Polynesia, is provisionally so named. This name, though in current use, is probably invalid. Tryon states that the prior name of *C. sagitta*, Gaskoin, belongs here, although Reeve's figure and the original locality are both at variance with the shell in question. This statement has neither been accepted nor denied by London writers; the latest reference to the species by Melvill and Standen ignores it. We owe the confusion in which this species is involved to the past generation of London Conchologists, and we expect reparation from the present. A perusal of literature suggests that an extensive synonymy will result from a revision of the nomenclature of this species. *Columbella mindorensis*, Reeve, and *C. articulata*, Souverbie, are suggested as probable additions to the names reduced by Tryon.

COLUMBELLA MELVILLI, sp. nov.

(Fig. 38).

Shell small, smooth, ovate. Colour white, irregularly longitudinally striped by narrow, brown, broken lines, which are interrupted at the periphery. Whorls seven, slightly rounded, glossy, traversed by a few, scarcely perceptible spiral grooves. Aperture narrow, outer lip straight, simple, not grooved within. *Columbella arcuate* above, denticulate below. Length $4\frac{1}{2}$, breadth $1\frac{3}{4}$ mm.

Rare, alive under stones in the Funafuti lagoon. Named in honour of the senior author of a catalogue of the shells of Lifu, so often quoted in these pages.

COLUMBELLA ALOFA, sp. nov.

(Fig. 39.)

Shell narrow, tall, spire acuminate. Colour cream, with widely spaced, narrow, orange longitudinal lines, and a series of large coral-red blots on the periphery. Whorls eight, the upper three longitudinally finely ribbed and crossed by revolving grooves, the remainder smooth, base sculptured by a few spiral cords. Aperture narrow, outer lip straight, simple, plicate within. Columella dentate, canal slightly recurved. Length 12, breadth 4 mm.



Fig. 38.



Fig. 39.

One specimen was brought alive from forty to eighty fathoms, on the western slope of Funafuti.

COLUMBELLA OBTUSA, Sowerby.

Tryon, *loc. cit.*, p. 181, pl. lix., figs. 59, 60.

Two specimens alive in the Funafuti lagoon.

Tryon quotes this from Fiji, Reeve from Huaheine, and Kobelt from Hawaii. It is in this Museum from the Solomons and the New Hebrides.

COLUMBELLA TRINGA, Lamarck.

Tryon, *loc. cit.*, p. 181, pl. lix., figs. 65, 66.

One specimen alive in the lagoon.

Tryon mentions this from New Caledonia and Fiji. It is in this Museum from Milne Bay, British New Guinea.

COLUMBELLA RUBICUNDA, Quoy & Gaim.

Quoy & Gaim., Voy. "Astrolabe," ii., 1832, p. 588, pl. xl., figs. 25, 26.

Schmeltz* records this from the Ellice, and also *Pyrene aurea*, Lamk.

ENGINA PARVA, Pease.

Tryon, *loc. cit.*, p. 195, pl. lxiii., fig. 55.

One dead shell on the lagoon beach. Found by Pease in the Paumotus.

ENGINA NODICOSTATA, Pease

Tryon, *loc. cit.*, p. 195, pl. lxiii., figs. 56, 57.

One living but immature shell from the lagoon of Funafuti.

Tryon records this species from the Paumotus and Fiji.

ENGINA MENDICARIA, Linne.

Tryon, *loc. cit.*, p. 196, pl. lxiii., figs. 62, 73.

Abundant in the rock pools of the outer beach of Funafuti.

Schmeltz names this from Samoa and Fiji, Melvill and Standen from the Loyalty Islands, Kobelt from New Ireland, and Brazier from Torres Straits. Specimens from Port Moresby, British New Guinea, are in this Museum.

MITRA EPISCOPALIS, Linne.

Tryon, *Man. Conch.*, iv., 1882, p. 111, pl. xxxii., fig. 1; Garrett, *Journ. Conch.*, iii., 1880, pp. 3, 14.

I collected several specimens of this mollusk alive, on sandy gravel flats, in the Funafuti lagoon at low water-mark. The shell

* Schmeltz—Cat. Godeffroy Museum, v., 1874, p. 125.

was formerly employed in the manufacture of native implements by the Funafuti people (see *ante* pp. 249, 259) who called it "mouri ounga."

Garrett records this species from the Fiji, Tonga, Samoa, Gilbert, Caroline, Cook, Society, Paumotu, and Hawaiian Groups. Melvill and Standen notice it from the Loyalty.* In this Museum it is also represented from Torres Straits, New Guinea, Solomon Islands, and New Caledonia.

MITRA PONTIFICALIS, *Lamarck*.

Tryon, *loc. cit.*, p. 111, pl. xxxii., fig. 3; Garrett, *loc. cit.*, pp. 4, 23.

Two examples occurred to me in company with the preceding species, and I secured a third at Nukulailai.

Garrett notes for this a range similar to that of *M. episcopalis*, with the addition of the Marquesas. Melvill and Standen publish it from the Loyalty Islands. Examples are in this Museum from Erromanga, New Hebrides, San Christoval, Solomons, and New Caledonia.

MITRA FLAMMEA, *Q. & G.*, var. HYSTRIX, *Montrouzier*.

Montrouzier, *Journ. de Conch.*, x., 1862, p. 241, pl. ix., fig. 8;

Tryon, *loc. cit.*, p. 140.

One example from Funafuti is longer and more slender than that described by Montrouzier. Tryon is responsible for the subordination of this form to *M. flammea*.

MITRA CUCUMERINA, *Lamarck*.

Tryon, *loc. cit.*, p. 143, pl. xlii., figs. 227 - 229; Garrett, *loc. cit.*, pp. 3, 14.

Several examples from the rock pools of the ocean beach of Funafuti.

The habitats enumerated by Garrett are: Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus, and Hawaii. Pease records it from the Ralick Islands.† I have taken it at Panie, New Caledonia.

MITRA CHRYSALIS, *Reeve*.

Tryon, *loc. cit.*, p. 144, pl. xlii., fig. 233; Garrett, *loc. cit.*, pp. 3, 13.

Abundant on the outer reef of Funafuti.

Garrett observed this in Fiji, Tonga, Samoa, and the Gilberts. New Caledonian specimens are also before me.

* Melvill & Standen—*Loc. cit.*, viii., p. 99.

† Pease—*Am. Journ. Conch.*, iv., 1868, p. 121.

MITRA TABANULA, Lk., var. CALEDONICA, Recluz.

Recluz, Journ. Conch., iv., 1853, p. 248, pl. vii., fig. 7; Tryon, *loc. cit.*, p. 146, pl. xlii., fig. 247.

A form represented by four specimens from the outer reef of Funafuti is thus doubtfully determined. It is smaller, smoother, and narrower than the shell figured by Recluz, but approaches nearer to it than to any other illustration.

MITRA FERRUGINEA, Lamarck.

Tryon, *loc. cit.*, p. 150, pl. xlv., figs. 279, 280, 290; Garrett, *loc. cit.*, pp. 3, 17.

Two specimens from the Funafuti lagoon.

Garrett cites this from Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, and Paumotus Islands.

MITRA ACUMINATA, Swainson.

Tryon, *loc. cit.*, p. 153, pl. xlv., fig. 312; Garrett, *loc. cit.*, pp. 5, 32.

Three examples from the Funafuti lagoon.

Garrett has recorded this from Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus, and Hawaiian Archipelagoes.

MITRA BRUNNEA, Pease.

Tryon, *loc. cit.*, p. 153, pl. xlv., fig. 301; Garrett, *loc. cit.*, pp. 5, 33.

A single specimen from Funafuti.

Garrett enumerates the known localities for this rather rare species: Fiji, Samoa, Carolines, Cook's, Society, Paumotus, and Hawaii. There is a specimen in this Museum from Howland's Island, North-Central Pacific; and Langkavel reports it from the neighbouring Baker's Island. P. P. Carpenter asserts,* and Pease denies,† that *M. brunnea* is a synonym of *Strigatella fuscescens*, Pease, from Hawaii.

MITRA ASTRICTA, Reeve.

Tryon, *loc. cit.*, p. 154, pl. lxx., figs. 315, 318.

A single live specimen from the Funafuti lagoon.

Tryon quotes this from Hawaii.

MITRA LIMBIFERA, Lamarck.

Tryon, *loc. cit.*, p. 154, pl. xlv., figs. 322 - 326; Garrett, *loc. cit.*, pp. 5, 33.

Three specimens from Funafuti lagoon.

* Carpenter—Proc. Zool. Soc., 1865, p. 517.

† Pease—Am. Journ. Conch., iii., 1867, p. 233.

Garrett records this as *S. columbellæformis*, Kiener, from the Gilberts, Cook's, Society, and Paumotus.

MITRA LITTERATA, Lamarck.

Tryon, *loc. cit.*, p. 155, pl. xlv., figs. 338, 339; Garrett, *loc. cit.*, pp. 5, 33.

In profusion in the rock pools on the ocean beach of Funafuti.

Garrett has traced this from Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, and Paumotus, to Hawaii. Melvill and Standen note it from the Loyalties.* From Lord Howe Island, New Caledonia, and Fanning Island, there are instances in the Museum collection.

MITRA PAUPERCULA, Linne.

Tryon, *loc. cit.*, p. 156, pl. xlv., fig. 340; Garrett, *loc. cit.*, pp. 5, 34.

Two specimens in company with the following species.

According to Garrett this form is confined to the West Pacific, ranging through Fiji, Tonga, Samoa, Gilberts, and Carolines. Melvill and Standen† recognise it from the Loyalty Islands.

MITRA VIRGATA, Reeve.

Tryon, *loc. cit.*, p. 156, pl. xlv., fig. 341; Garrett, *loc. cit.*, pp. 5, 34.

Several specimens from the outer reef of Funafuti.

Garrett gives the range of this as identical with that of *M. paupercula*. It is in this Museum from New Caledonia.

TURRICULA GRUNERI, Reeve.

Tryon, *loc. cit.*, p. 168, pl. xlix., figs. 416, 418, 419; Garrett, *loc. cit.*, p. 47.

Two specimens were found on the lagoon beach at Funafuti.

Garrett reports this from Upolu, Samoa, and the Pelew Islands. It is represented in this Museum from New Caledonia, and the Gilberts.

TURRICULA ANGULOSA, Kuster.

Tryon, *loc. cit.*, p. 169, pl. l., figs. 431, 432; Garrett, *loc. cit.*, pp. 5, 37.

One specimen from Funafuti.

Found by Garrett in Fiji.

TURRICULA VARIATA, Reeve.

Tryon, *loc. cit.*, p. 193, pl. lvi., fig. 635; Garrett, *loc. cit.*, pp. 7, 61.

One specimen from Funafuti.

* Melvill & Standen—*Loc. cit.*, viii., p. 101.

† Melvill & Standen—*Loc. cit.*, viii., p. 101.

Taken by Garrett at Fiji, Samoa, Cook's, Society, and Paumotu Groups.

TURRICULA NODOSA, Swainson.

Tryon, *loc. cit.*, p. 193, pl. lvi., figs. 638–641; Garrett, *loc. cit.*, pp. 6, 53.

One dead specimen from Funafuti.

Garrett records this from Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotu, and Hawaii. Melvill and Standen observe it from the Loyalties.* There is an example in this Museum from Niue.

TURRICULA PILSBRYI, sp. nov.

(Fig. 40).

Shell fusiform. Colour orange-buff, with a rosy apex. Whorls five, plus the protoconch. Sculpture—on the last whorl are six roundly swelling arcuate ribs, which arise at the suture and terminate at the basal constriction, but disappear on the final half whorl; the antepenultimate has thirteen ribs. On ascending the spire, the ribs become comparatively more prominent, and on the earliest whorl are sharply constricted and angled at their upper third. On each whorl they alternate with those above and below. Between the ribs appear delicate and evenly-spaced, spiral grooves. Seven or eight broad, close, flat-topped lyreæ are obliquely wound around the base. Protoconch two-whorled, globose, projecting on the right side, smooth; anteriorly a spiral groove forecasts the constriction of a later whorl. In the unique specimen the lip is broken. The columella bears a tubercle at the posterior angle, it is then excavated; the moderately straight pillar carries four, conspicuous, projecting plaits; a callus is spread over the preceding whorl. The throat is on its outer wall corrugated by a dozen raised spiral lines. Length 6, breadth $2\frac{1}{2}$ mm.



Fig. 40.

Taken by the tangles hauled up on the outer western slope of the atoll, in eighty to forty fathoms, associated with *Gorgonidae*, *Thetidos*, etc.

This species is a member of the subgenus *Pusia*, and seems well defined by the uniform colour, smooth, wave-like ribs, and basal constriction.

* Melvill & Standen—*Loc. cit.*, viii., p. 103.

Named in honour of the brilliant American Conchologist, who has so successfully laboured to place the systematic study of the Mollusca on a more scientific basis.

CYLINDRA DACTYLUS, *Linne.*

Tryon, *loc. cit.*, p. 197, pl. lvii., figs. 658, 664 ; Garrett, *loc. cit.*, pp. 7, 65.

Three specimens from the Funafuti lagoon.

Garrett found this at Fiji, Tonga, Samoa, Gilberts, Carolines, Society, Paumotus, and Hawaii. Melvill and Standen quote it from the Loyalties.* Examples from Woodlark Island (British New Guinea), and New Caledonia, are contained in this Museum.

ERATO SCHMELTZIANA, *Crosse.*

Tryon, *Man. Conch.* v., 1883, p. 11, pl. iv., figs. 54, 55.

A few specimens were collected on the beach of the Funafuti lagoon.

Previously reported only from Fiji.

MARGINELLA SANDWICENSIS, *Pease.*

Tryon, *loc. cit.*, p. 45, pl. xii., fig. 69.

Several dead shells were picked up on the beach of the Funafuti lagoon.

Tryon reports it from Hawaii and Fiji.

MARGINELLA IOTA, sp. nov.

(Fig. 41).

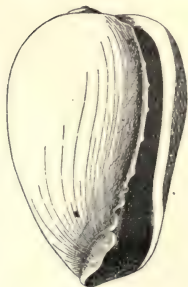


Fig. 41.

Shell ovate, truncate anteriorly, white, smooth. Spire slightly exserted. Aperture comparatively wide. Outer lip thick, sinuate, smooth within. Inner lip with three principal anterior plications and several remote subsidiary ones, deep within. Length 1·5, breadth ·95 mm.

Three specimens from the sand of the lagoon beach.

The only *Marginella* comparable in size, known from the tropical Pacific, is *M. mariei*, Crosse, whose broad shell and immersed spire easily distinguish it.

MARGINELLA PEASII, *Reeve.*

Tryon, *loc. cit.*, p. 53, pl. xiii., fig. 27.

Abundant in a dead state on the sandy beach of the lagoon.

* Melvill & Standen—*Loc. cit.*, viii., p. 103.

Hitherto only known from the Gilberts. *Volutella elongata* (*Marginella elliptica*, Redfield),* from Fanning Island, seems suspiciously close to this.

OLIVELLA SIMPLEX, Pease.

Tryon, *loc. cit.*, p. 72, pl. xvii., figs. 47, 48.

A single dead shell was found with the foregoing species.

Reported by its author from Upolu, Samoa, and Tongatabu, Tonga.

OLIVA GUTTATA, Lamarck.

Tryon, *loc. cit.*, p. 74, pl. xix., figs. 64–74.

A dead specimen was found on the beach of the lagoon.

In this Museum it is represented from Trinity Bay, North Queensland, New Caledonia, and New Hebrides.

OLIVA IRISANS, var. ERYTHROSTOMA, Lamarck.

Tryon, *loc. cit.*, p. 80, pl. i., fig. 3; pl. xxvi., figs. 53, 54; pl. xxvii., figs. 55–58; pl. xxxiv., fig. 53.

A few empty shells were found upon the beach.

Melvill and Standen mention this from Lifu. Specimens are included in the series of this Museum from Niue, Tonga, and Erromanga (New Hebrides).

HARPA MINOR, Lamarck.

Tryon, *loc. cit.*, p. 99, pl. xli., figs. 69–72, 78.

Several dead shells were noticed on the lagoon beach.

Schmeltz records this from Fiji and the Gilberts, and Melvill and Standen from Lifu. It is in this Museum from the Solomons.

HARPA GRACILIS, Broderip & Sowerby.

Tryon, *loc. cit.*, p. 99, pl. xli., fig. 73.

A single dead shell of this rare species was taken on the lagoon beach.

H. Cuming discovered this at Anaa, Paumotu. Schmeltz gives it from the Gilberts and Rarotonga.

DRILLIA UNIZONALIS, Lamarck.

Tryon, *Man. Conch.*, vi., 1884, p. 185, pl. ix., figs. 30, 33, 34, 38; pl. xxxii., fig. 48.

One specimen from Funafuti lagoon.

* Pease—*Am. Journ. Conch.*, iii., 1867, p. 281, pl. xxiii., fig. 23.

Under the synonym of *D. vidua*, Reeve, this is quoted by Garrett* from Fiji and Wallis Island; by Melvill and Standen† from Lifu; and by Weinkauff‡ from Upolu, Samoa. I have collected it at Port Moresby, British New Guinea.

GLYPHOSTOMA PURPURASCENS, *Dunker*.

Dunker, Malak. Blatt., xviii., 1871, p. 160.

Clathurella pulchella, Garrett, Proc. Acad. Nat. Sci. Phil., 1873, p. 219, pl. iii., fig. 32.

Glyphostoma goubini, Hervier, Journ. de Conch., xliii., 1895 (1896), p. 149; xliv., 1896 (1897), p. 75, pl. ii., fig. 17.

Seven specimens from the lagoon at Funafuti.

Tryon writes that *G. purpurascens* "is admitted by Mr. Garrett to be identical with his *C. pulchella*, over which it has two years' priority of publication."§ The figure and description of Father Hervier so exactly correspond to the others quoted, that I fear no contradiction in reducing his name to synonymy. Possibly the unfigured *C. rubicunda*, Gould,|| is the same species.

Dunker described it from Upolu (Samoa), Garrett from Fiji, and Hervier from Lifu (Loyalties). If the prior *Clathurella rubicunda*, Gould, is identical, the range includes the Loo Choo Islands.

GLYPHOSTOMA ALICEÆ, *Melvill & Standen*.

Melvill & Standen, Journ. Conch., viii., 1895, p. 95, pl. ii., fig. 15 (bad).

Three specimens from Funafuti agree generally with an authentic example from Lifu. The photographic illustration quoted is too indistinct to show details.

GLYPHOSTOMA ALICEÆ, *M. & S.*, var. TENERA, var. nov.

This variety differs in sculpture from the preceding, having on the last whorl fifteen delicate costæ, where the typical form bears eight, thick and prominent ribs. At the anterior termination of these ribs, the variety has a more decided angle, followed by a more hollow base, than the species in chief.

Five specimens from the lagoon beach.

GLYPHOSTOMA MALLETI, *Recluz*.

Recluz, Journ. de Conch., iii., 1852, pl. x., fig. 2; Tryon, *loc. cit.*, p. 297, pl. xx., figs. 96, 100.

* Garrett—Proc. Acad. Nat. Sci. Phil., 1873, p. 218.

† Melvill & Standen—*Loc. cit.*, viii., p. 94.

‡ Weinkauff—Conch. Cab. (ii.), iv., 1, 1887, p. 60.

§ Tryon—*Loc. cit.*, p. 298.

|| Gould—Proc. Boston Soc. Nat. Hist., vii., 1861, p. 338.

A single specimen was taken in company with the *Gorgonidae* described *ante* p. 308–320, by tangles hauled from eighty to forty fathoms on the outer and western slope of Funafuti. It differs considerably from a specimen (apparently typical) received from New Caledonia, being of a chrome-orange colour, with a pale peripheral band, 5 mm. long by 2 broad. Whereas the New Caledonian example is of a peach-blossom pink colour, $6\frac{1}{2}$ mm. long, 3 mm. broad, and of a stouter build. Both show the granulations noted in the original description which Dall points out as characteristic of the genus.*

Garrett found this in Samoa and Fiji, and Melvill and Standen received it in abundance from Lifu, Loyalties.†

THETIDOS, gen. nov.

A member of the Mangiliinae, distinguished by three stout tubercles seated on the lip within the aperture, and by a globose, tilted, two-whorled protoconch, which is closely spirally grooved throughout.

The new species, which typifies this proposed new genus, stands apart from almost all Pleurotomidae, with regard to the few large denticles which defend the aperture. The thickened lip and anal notch throw it into Tryon's subfamily Mangiliinae, and among the members of that, *Glyphostoma* makes the nearest approach. *Glyphostoma* has smaller and more numerous denticles, and an apex which in *G. gabbi* is thus described by Dall:—"nucleus acute, three-whorled, the first whorl smooth, rounded, tilted, minute; the others smooth, polished, keeled on the periphery."‡ This description fits others I have examined such as *G. malleti*. In various instances the protoconch of *Mangelia* is shown by Watson to have delicate, longitudinal ribbing. The genus *Clathurella* has a peculiar raised mesh-work over all the whorls of the protoconch, as here illustrated in the case of *C. irretita*, and which * has been beautifully figured in several instances by Watson in the "Challenger" Report. The apex which Cossman gives as characteristic of *Clathurella* is, however, quite different.§

Opinions on the systematic importance of the Pleurotomoid protoconch are conflicting. Watson remarks that:—"sculpture and form of apex may probably serve as the safest basis of classification in the whole group."|| On the contrary Dall has expressed his opinion that:—"so far as our knowledge goes, nuclear

* Dall—Bull. Mus. Comp. Zool., xviii., 1889, p. 108.

† Melvill & Standen—*Loc. cit.*, p. 402.

‡ Dall—*Loc. cit.*, p. 109.

§ Cossman—*Essais de Paléoconchologie comparée*, ii., 1896, p. 122.

|| Watson—Chall. Rep. Zool., xv., 1886, p. 361.

characters have little absolute systematic value in this group, and their relative value remains to be determined.”*

Even should little weight attach to the nuclear distinction of *Thetidos*, the aperture, so curiously imitating *Sistrum* or *Pupa*, may separate it from its kindred, only excepting *Clathurella idiomorpha*, Hervier,† and *Clathurella rugosa*, Mighels.‡ As those authors paid no special attention to the protoconch, I am unable to decide whether they should also enter my genus.

I have no information relative to the presence or absence of the operculum, since to obtain such would entail the destruction of the only shell. It may be that in this family the thickening of the lip, followed by the development of the labial teeth, and consequent narrowing of the aperture has accompanied the degeneration of the operculum. The safety of the animal being thus secured by the exchange of one defence for another.

THETIDOS MORSURA, sp. nov.

(Fig. 42).



Fig. 42.

Shell stout and strongly built, briefly conical, a little turreted, anteriorly narrowed suddenly with a short straight and truncate canal. Whorls five, exclusive of the protoconch. Colour dead white, except the two uppermost whorls and the protoconch, which are pale fawn. Sculpture—the last whorl has ten thick and prominent ribs, round at their base and summit, their own width apart, shouldered posteriorly and abruptly terminating anteriorly at the basal con-

striction. On each succeeding whorl the ribs alternate with those beneath. The revolving sculpture consists, on the last whorl, of eight, strong, elevated, equidistant, narrow spiral cords which over-ride the ribs, and five such which encircle the base, where vestigial ribs tend to dissect them into nodules; on the penultimate whorl there are four to five cords visible. Protoconch tilted, two-whorled, and spirally grooved. Aperture narrow; columella

* Dall—*Loc. cit.*, p. 75.

† Hervier—*Journ. de Conch.*, xliv., 1896 (1897), p. 147; xlv., 1897, p. 110, pl. iii., fig. 3.

‡ Langkavel—*Donum Bismarckianum*, 1871, p. 2, pl. i., fig. 5.

excavate above, anteriorly ridged by the entrance of three of the basal cords which ascend obliquely; canal open, broad, short, truncated; outer lip much thickened externally by a heavy varix which is crossed and denticulated by the spiral sculpture; within the varix, and at right angles to it, the aperture proper has a second raised lip, and within that again are three large, equidistant tubercles, the largest and most prominent of which is that next the sinus; the anal sinus is moderately deep, scarcely mounts on the preceding whorl, and spreads a callus across two ribs. Length $5\frac{1}{2}$, breadth $2\frac{1}{2}$ mm.

One example, procured in eighty to forty fathoms by the tangles, with the preceding species.

MANGILIA HIMERTA, *Melvill & Standen*.

Melvill & Standen, Journ. Conch., viii., 1896, p. 281, pl. ix., fig. 17.

One example from the lagoon beach. Only before recorded from Lifu.

CLATHURELLA LACTEA, *Reeve*.

Reeve, Conch. Icon. i., 1843, Pleurotoma, pl. xv., sp. 123.

One specimen from the lagoon beach answers well to Reeve's illustration.

CLATHURELLA CLANDESTINA, *Deshayes*.

Tryon, *loc. cit.*, p. 298, pl. xix., fig. 67; pl. xx., fig. 81.

One specimen from the Funafuti lagoon, slighter and paler than the typical form. It is only 4 mm. long, and has a buff tip and two obscure buff bands on the back of the last whorl.

Pease found this in the Paumotus, Garrett in Fiji, and Hadfield at Lifu.* I collected a large form, 7 mm. in length, at Milne Bay, British New Guinea. According to the descriptions, *C. pumila*, Mighels, seems scarcely separable.

CLATHURELLA APICALIS, *Montrouzier*.

Montrouzier, Journ. de Conch., ix., 1861, p. 277, pl. xi., fig. 1.

Two worn specimens from the beach of the Funafuti lagoon.

Tryon† relegates this to the synonymy of *C. felina*, Hinds. As Reeve's miserable figure of this permits no comparison, I accept without criticism Hervier's assurance‡ that it is distinct.

* Melvill & Standen—*Loc. cit.*, viii., p. 402.

† Tryon—*Loc. cit.*, p. 293.

‡ Hervier—*Loc. cit.*, xlv., 1897, p. 101.

CLATHURELLA IRRETITA, sp. nov.

(Fig. 43).

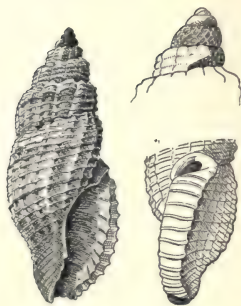


Fig. 43.

Shell ovate-fusiform, narrow, turretted and sharply angled below a sloping shoulder. Colour white, from the suture to the angle opaque, below the angle hyaline with opaque beads; protoconch buff yellow, a splash of the same on the anterior dorsal portion of the last whorl; a pale yellow thread, confined to one spiral cord, ascends each whorl below the angle, and another surrounds the last whorl below the periphery. Adult whorls four and a half. Sculpture—the last whorl bears fifteen longitudinal costæ which cross the flattened part of the whorl obliquely, here they are separated by twice their breadth; above

the angle they bend and enlarge suddenly, towards the base they curve in and vanish at the basal constriction. On the penultimate whorl these costæ alternate with those below the suture. These longitudinal costæ are over-ridden by a series of fine sharp spiral cords knotted at each costæ; the last whorl carrying four larger and more undulating ones above the angle and ten below it; on the base are six simple cords. Protoconch horny, mamillate, three and a half whorled, the larger sculptured with a raised network, contrasting sharply by colour and texture with the adult shell, which suddenly commences with a thick raised white tongue at the suture. Aperture narrow and elliptical, columella arched, overlaid by a callus which ends abruptly where the mouth narrows. Canal short and wide. Outer lip massive, ridged externally by a dozen transverse cords which denticulate the edges; within are seven weak entering ridges. The aperture mounts the preceding whorl to the height of two spiral cords, and encloses a deep wide anal notch with a prominent callus. Length 5, breadth 2 mm.

One specimen from the lagoon beach of Funafuti.

Closely allied to *Clathurella euzonata*, Hervier,* from which it differs by being narrower, sharper angled, and sculptured by finer and more numerous cords. With his species Hervier associates *C. bilineata*, Angas, and *C. bifasciatum*, Pease.

DAPHNELLA DELICATA, Reeve.

Reeve, Conch. Icon., i., 1846, "Pleurotoma," pl. xxxiv., sp. 310;
Tryon, loc. cit., p. 301, pl. xxvi., fig. 80.

* Hervier—Journ. de Conch., xlv., 1896 (1897), p. 143; *ibid.*, xlv., 1897, p. 102, pl. ii., fig. 6.

One specimen from the Funafuti lagoon beach.

It has been taken by Cuming at Marutea, Paumotus, and by Garrett at Tahiti.

DAPHNELLA LYMNEIFORMIS, *Kiener*.

Kiener, *Coquilles Vivantes, Canalifères*, i., (n.d.), *Pleurotome*, p. 62, pl. xxii., fig. 3.

Two specimens from Funafuti appear to be the first recorded from the Central Pacific of this widely distributed form.

DAPHNELLA PUPOIDEA, *H. Adams*.

H. Adams, *Proc. Zool. Soc.*, 1872, p. 14, pl. iii., fig. 27; Tryon, *loc. cit.*, p. 314, pl. xxxiv., fig. 92.

Mangilia victor, Sowerby, *Proc. Malac. Soc.*, i., 1894, p. 45, pl. iv., fig. 19.

The single specimen from Funafuti is smaller and slighter than Adams' type specimen, from the New Hebrides, now in the Australian Museum. Melvill and Standen report it* from Lifu, Loyalties, and I have obtained it at Port Moresby, British New Guinea, and at Panie, New Caledonia. *Drillia pygmæa*, Dunker, seems to be suspiciously like this species.

DAPHNELLA THIASOTES, *Melvill & Standen*.

Mangilia thiasotes, Melvill & Standen, *Journ. Conch.*, viii., 1896, p. 284, pl. ix., fig. 21.

A more complete account than is usually given by these authors enables me to satisfactorily identify a single specimen from Funafuti with their species from Lifu. They confess, "We know of no pleurotomoid shell which presents the same characteristics." If specific characters were thus alluded to in a shell described as new, the remark would be superfluous, and I therefore presume that generic characters are intended. It is obvious that this species is a close ally of such a shell as Angas described as *Purpura anomala*. Prof. R. Tate first pointed out that this latter was one of the *Pleurotomidæ*, allied to *M. vincenti*, Crosse.† In consonance with Tryon's classification, it is therefore here termed *Daphnella thiasotes*.

CONUS LITERATUS, *Linne*.

Tryon, *loc. cit.*, p. 10, pl. ii., figs. 17 - 19; Garrett, *Journ. Conch.*, i., 1878, pp. 354, 360.

I purchased a specimen of this from a native at Nukulailai.

* Melvill & Standen—*Loc. cit.*, viii., p. 94.

† Tate—*Proc. Linn. Soc. N.S.W.*, v., 1881, p. 131.

H. Cuming collected a form of this at Tahiti and Anaa, Paumotu.* Garrett found it in Fiji, the Gilberts, the Carolines, and Society Islands. In an excellent "Catalogue of the Cones of New Caledonia," by Crosse and Marie,† this is recorded from the mainland, Ile Art, and the Loyalty Group. In this Museum it is also represented from British New Guinea, Erromanga (New Hebrides), and the Bampton Reef (Coral Sea). Throughout the Pacific, this shell is greatly esteemed as material for native ornaments.

CONUS TESSELLATUS, *Born.*

Tryon, *loc. cit.*, p. 11, pl. ii., figs. 26, 27; Garrett, *loc. cit.*, pp. 355, 365.

A couple of specimens were procured at Funafuti.

Garrett reports this from Fiji, Samoa, Gilberts, Carolines, Cook's, Society, and Hawaii. Crosse and Marie mention this from Balade and Ile Art, New Caledonia. In this Museum are specimens from the New Hebrides and Torres Straits.

CONUS PULICARIUS, *Hwass.*

Tryon, *loc. cit.*, p. 19, pl. iv., fig. 68; pl. v., fig. 69; Garrett, *loc. cit.*, pp. 355, 362.

Two examples were obtained at Funafuti.

Garrett records this from Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotu, and Marquesas Islands. Cuming observed this at Tahiti‡; Crosse and Marie at Ile Art and New Caledonia; and Melvill and Standen at Lifu. Tryon mentions it from New Guinea, and specimens are in this Museum from Queensland, the Solomons, and the Gilberts.

CONUS HEBRAEUS, *Linne.*

Tryon, *loc. cit.*, p. 20, pl. v., figs. 75, 77; pl. xxvii., fig. 13; Garrett, *loc. cit.*, pp. 354, 360.

Abundant on the outer reef in rock pools at Funafuti, and I noted it also at Nukulailai.

Garrett cites this from Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotu, and Hawaii. Crosse and Marie quote it from New Caledonia. In this Museum it is shown from the Louisiades, Erromanga, New Hebrides, and Lord Howe Island.

The native name on Funafuti is "miri." At Port Moresby the natives call it "ahukura."

* Reeve—Conch. Icon., i., Conus, 1843, pl. xxxii., sp. 178.

† Crosse & Marie—Journ. de Conch., 1874, p. 344.

‡ Reeve—Loc. cit., pl. xvii., sp. 94.

CONUS HEBRAEUS, var. *VERMICULATUS*, *Hwass.*

A few of this colour variety occurred as usual with the typical form.

CONUS CEYLONENSIS, *Hwass.*

Tryon, *loc. cit.*, p. 23, pl. vi., figs. 94 – 100.

Abundant in the rock pools of the outer reef of Funafuti, in association with the preceding species. Numerous colour varieties are represented, among which is the var. *sponsalis*, Chemnitz.

Cuming collected this at Marutea, Paumotus* ; Crosse and Marie report it from Ile Art, New Caledonia ; and Melvill and Standen from Lifu. In a catalogue of the shells of Fitzroy Island,† Brazier notes it from there and from San Christoval, Solomons.

CONUS VEXILLUM, *Gmelin.*

Tryon, *loc. cit.*, p. 39, pl. xi., figs. 12a, 13, 14 ; Garrett, *loc. cit.*, pp. 356, 365.

One imperfect shell was purchased from a native at Funafuti.

Garrett found this in the Fiji, Tonga, Samoa, Gilberts, Cook's, Paumotus, and Hawaii Groups. Crosse and Marie mention this from New Caledonia, Ile Art, and Lifu ; Tryon from Samoa ; and there is a specimen in this Museum from Torres Straits. I have also collected it at Ballina, N.S. Wales.

CONUS RATTUS, *Hwass.*

Tryon, *loc. cit.*, p. 41, pl. xii., figs. 25, 27.

A single living specimen was taken under a stone in the Funafuti lagoon.

Cuming saw this at Tahiti, and Anaa, Paumotus‡ ; Crosse and Marie record it from Lifu and New Caledonia, and Weinkauff from Tonga.§ A specimen from the Bampton Reef, Coral Sea, is in this Museum.

CONUS CAPITANEUS, *Linne.*

Tryon, *loc. cit.*, p. 40, pl. xii., figs. 21 – 24 ; pl. xi., figs. 17, 18.

Garrett, *loc. cit.*, pp. 354, 358.

One dead and immature shell from Funafuti.

Garrett found this in Fiji, Tonga, Samoa, Gilberts and Carolines. Crosse and Marie mention this from Ile Art, New Caledonia, and Brazier from Fitzroy Island, Queensland ; Torres Straits ; Hall Sound, British New Guinea ; Fiji, New Ireland, New Britain

* Reeve—*Loc. cit.*, pl. xx., sp. 109.

† Brazier—*Journ. Conch.*, ii., 1879, p. 190.

‡ Reeve—*Loc. cit.*, pl. xv., sp. 78.

§ Weinkauff—*Conch. Cab.*, 1873, *Conus*, p. 134.

and the Solomons. A specimen from the Bampton Reef is in this Museum.

CONUS LIVIDUS, *Hwass.*

Tryon, *loc. cit.*, p. 45, pl. xiii., figs. 54–57; Garrett, *loc. cit.*, pp. 354, 360.

One specimen was found alive under a stone in the Funafuti lagoon.

Garrett saw this in Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus, Marquesas and Hawaii. By Cuming it was taken in the Society Islands; Melvill and Standen have it from the Loyalty. Specimens in this Museum extend the range to Woodlark Island, British New Guinea and the Solomons.

CONUS LIVIDUS, var. *FLAVIDUS*, *Lamarck.*

Tryon, *loc. cit.*, p. 44, pl. xiii., figs. 48–50.

Abundant alive under stones in the Funafuti lagoon.

Cuming collected this at Tahiti, Crosse and Marie cite it from Ile Art, New Caledonia; Smith from the Solomons, Fiji, and Tonga*; and Brazier from Torres Straits and Hall Sound, British New Guinea.† An Hawaiian specimen is contained in this Museum.

CONUS VITULINUS, *Hwass.*

Tryon, *loc. cit.*, p. 51, pl. xiv., figs. 86, 87; pl. xv., fig. 88.

One dead specimen from Funafuti.

Crosse and Marie cite this from the Loyalty Islands, Ile Art and Balade, New Caledonia. Brazier found it at Fitzroy Island, Queensland, Torres Straits, New Britain and New Ireland.

CONUS CATUS, *Hwass.*

Tryon, *loc. cit.*, p. 63, pl. xx., figs. 6–10; Garrett, *loc. cit.*, pp. 354, 358.

A single worn specimen from Funafuti.

Cuming collected this at Tahiti; Crosse and Marie record it from New Caledonia and the Loyalty Group. This Museum has a specimen from Hawaii. Garrett found it in Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus and Hawaii.

CONUS NUSSATELLA, *Linne.*

Tryon, *loc. cit.*, p. 80, pl. xxv., fig. 35; Garrett, *loc. cit.*, pp. 355, 362.

Mr. G. Sweet obtained one specimen.

Garrett notes this from Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, Paumotus and Hawaii.

* Smith—Proc. Zool. Soc., 1891, p. 400.

† Brazier—Proc. Linn. Soc. N.S.W., i., 1877, p. 288.

CONUS STRIATUS, Linne.

Tryon, *loc. cit.*, p. 85, pl. xxvi., fig. 67; Garrett, *loc. cit.*, pp. 355, 364.

A single empty shell from Funafuti.

Garrett collected this at Fiji, Tonga, Samoa, Gilberts, Carolines, Cook's, Society, and Hawaii. Crosse and Marie record this from the east coast of New Caledonia, and the Islands of Art and Lifu. Brazier has noted it from Fitzroy Island, Queensland, Torres Straits, New Ireland and New Britain; and Smith from the Solomons. In this Museum are specimens from Erromanga, New Hebrides, and the Bampton Reef, Coral Sea.

CONUS GEOGRAPHUS, Linne.

Tryon, *loc. cit.*, p. 88, pl. xxviii., fig. 84; pl. xxix., fig. 85; Garrett, *loc. cit.*, pp. 354, 360.

A native of Funafuti presented me with a fine specimen, 120 mm. in length.

Garrett saw this at Fiji, Samoa, Gilberts, Carolines, Society and Paumotus. Crosse and Marie mention this from the Islands of Loyalty, Art and Pines, New Caledonia. This Museum possesses representatives from Fiji, the Solomon Islands and Erromanga, New Hebrides.

CONUS TULIPA, Linné.

Tryon, *loc. cit.*, p. 87, pl. xxviii., figs. 80, 81; Garrett, *loc. cit.*, pp. 355, 365.

I picked up a single specimen on the western beach of Funafuti.

Garrett obtained this at Fiji, Tonga, Samoa, Gilberts, Cook's, Society, Paumotus, Marquesas and Hawaii. Crosse and Marie note it from the Islands of Lifu, Art and Pines, New Caledonia. Examples from Torres Straits and Erromanga, New Hebrides, exist in this Museum.

CONUS AURATUS, Lamarck.

Tryon, *loc. cit.*, p. 93, pl. xxxi., fig. 30; Garrett, *loc. cit.*, pp. 354, 357.

One dead shell from the lagoon beach of Funafuti.

Found by Cuming at Anaa, Paumotus, and noted by Crosse and Fischer from the Loyalty. In this Museum are instances from the Gilberts and Erromanga, New Hebrides. Garrett collected this at Fiji, Gilberts and Paumotus.

TEREBRA CRENULATA, Linne.

Tryon, *Man. Conch.*, vii., 1885, p. 8, pl. i., figs. 1, 2, 6.

Several imperfect specimens were observed on the lagoon beach of Funafuti.

Hinds remarks this from the Society and Marquesas, and Melvill and Standen from Lifu; this Museum contains it from Pipon Island and New Caledonia.

TEREBRA DIMIDIATA, Linne.

Tryon, *loc. cit.*, p. 9, pl. i., figs. 4, 13.

Fragments only of this were collected at Funafuti by myself, but Mr. G. Sweet showed me a whole one.

Hinds reports this from Tahiti; Melvill and Standen from Lifu. It is in this Museum from British New Guinea, and Erromanga and Aneiteum, New Hebrides.

TEREBRA MACULATA, Linne.

Tryon, *loc. cit.*, p. 9, pl. i., figs. 9, 10.

This shell is a rarity on Funafuti, and I was unable to personally obtain a specimen, though I identified the species from one purchased from the natives by another member of our party. A specimen was also obtained by Mr. G. Sweet. It was formerly of great value to the inhabitants of this and other Pacific Islands, who employed it as a cutting or boring edge for certain tools.* Dr. Hinds, who found a dwarf form at Hao Atoll, Paumotus, remarks:—"In the Pacific, the animal is eaten as food, and the shell, ground at an angle, was much in use as a chisel in the construction of the canoes."†

The "Chevert" Expedition obtained this in Torres Straits. Melvill and Standen note it from Lifu. I collected it at Port Moresby, British New Guinea, where the natives knew it as "bodoa."

TEREBRA SUBULATA, Linne.

Tryon, *loc. cit.*, p. 10, pl. i., fig. 3; pl. iii., fig. 35.

One specimen was found by Mr. G. Sweet.

Hinds found it at Hao and Tahiti. It is represented from the Solomons, New Caledonia, and Hawaii in this Museum.

TEREBRA TIGRINA, Gmelin.

Tryon, *loc. cit.*, p. 10, pl. i., fig. 11.

Mr. G. Sweet obtained two examples. Reported by Tryon from Hawaii, and represented in this Museum from the New Hebrides.

TEREBRA AFFINIS, Gray.

Tryon, *loc. cit.*, p. 14 pl. ii., figs. 18, 22.

Two worn shells were taken on the Funafuti beach.

* See *ante* pp. 249, 259.

† R. B. Hinds—*Thes. Conch.*, i., 1847, p. 150.

Tryon quotes this from Fiji, and Melvill and Standen from Lifu. Schmeltz mentions it from Tahiti and Upolu, Samoa.* Specimens from the New Hebrides are in the possession of this Museum.

SOLIDULA SULCATA, Gmelin.

Pilsbry, Man. Conch., xv., 1893, p. 143, pl. xxa, figs. 39, 46, 47, 48.

Several specimens from the lagoon beach.

This abundant, variable and widespread species has been reported from Queensland and New Caledonia by Brazier, and from Tahiti by Pilsbry. It is represented in the Museum Collection from Guam in the Ladrões and from Aneiteum in the New Hebrides.

TORNATINA VOLUTA, Quoy & Gaimard.

Pilsbry, Man. Conch., xv., 1893, p. 195, pl. xxii., figs. 29, 30, 31.

Abundant on the lagoon beach.

Taken originally at Guam in the Ladrões by the "Astrolabe," it was afterwards found in Torres Straits by the "Chevert" and in Fiji by the "Challenger." Melvill and Standen note it from the Loyalty Islands, and I have myself collected it at Noumea, New Caledonia.

TORNATINA HADFIELDI, Melvill & Standen.

Melvill & Standen, Journ. Conch., viii., 1896, p. 314; pl. xi., fig. 80.

Some broken specimens from the lagoon beach appear to belong to this species, which Melvill and Standen describe from Lifu, and which I have also taken at Panie, New Caledonia.

RETUSA WAUGHIANA, sp. nov.

(Fig. 44).



Fig. 44.

Shell subcylindrical, swollen below, sharply truncated above, produced and rounded anteriorly. Colour porcelain white, glossy. Sculpture—longitudinal, irregularly spaced ribs traverse the whole shell, anteriorly they are weak threads, posteriorly they wax stouter and form tubercles as they obliquely mount the vertex. Between these the shell is closely girt by about forty spiral grooves and their complementary ridges. Whorls four, the earlier ascending, the last descending. Suture deeply channelled. Apex mamillate, rising above the crown. Aperture very oblique, racquet shaped. Outer lip springing from the wall considerably below the vertex, rounded posteriorly, parallel with the body whorl as far

* Schmeltz—Mus. Godeffroy Cat. v., 1874, p. 134.

as the waist of the shell, then curving outwards. Columella broad, sinuate, folded over a slight umbilical chink. Callus on body whorl distinct, forming a decided angle posteriorly. Length $1\frac{3}{4}$, breadth 1 mm.

Three specimens from the lagoon beach.

This species perhaps stands nearest to *R. amphizosta*, Watson,* from which it is easily distinguished by the even more puffed anterior half, the descent of the last whorl, and by the coarser, more prominent sculpture. The young shells differ altogether in contour from the adult, but may be recognised by their peculiar sculpture.

This novelty is named in honour of my accomplished friend, Lieutenant A. Waugh, R.N., of H.M.S. "Penguin," who, during the Expedition to Funafuti, as on many previous occasions, afforded his hearty aid and sympathy to every scientific undertaking.

ATYS CYLINDRICA, *Helbling*.

Pilsbry, Man. Conch., xv., 1893, p. 265, pl. xxxiii., figs. 60 – 64.

Abundant on the lagoon beach.

This common Pacific shell ranges in Australia from Torres Straits southwards to Port Stephens, N.S.W.; the "Challenger" met it in Fiji; I took it at Noumea, New Caledonia, and the Museum has received from Mr. N. Hardy a specimen he collected at Aneiteum, New Hebrides.

ATYS HYALINA, *Watson*.

Pilsbry, *loc. cit.*, p. 271, pl. xxxii., fig. 36.

A single broken specimen from the Funafuti lagoon agrees with specimens in the Museum from a type locality, Torres Straits. The "Challenger" procured this from Fiji, and doubtfully from Honolulu.

ATYS DENTIFERA, *A. Adams*.

Pilsbry, *loc. cit.*, p. 276, pl. xxvii., fig. 81.

The occurrence of several specimens on the lagoon beach of Funafuti points to a range across the whole Pacific, since this habitat is intermediate between Marutea, Paumotu, in the extreme east, where it was first discovered by Hugh Cuming, and Torres Straits in the extreme west, where it was taken by the "Challenger," as also at Fiji. Mr. H. Smithurst has presented to the Museum a specimen he collected at Milne Bay, British New Guinea.

* Watson—Chall. Rep., Zool., xv., 1886, p. 652, pl. xlvi., fig. 11.

ATYS DACTYLUS, sp. nov.

(Fig. 45).



Fig. 45.

Shell date shaped, truncated above and below, minutely perforate above, deeply and narrowly umbilicate below. Colour white, glossy. Sculpture—from sixty to seventy, irregularly waved, narrow, shallow grooves girdle the shell, between which are smooth, flat topped lyræ, two or three times their breadth; these are crossed at irregular intervals by fine and coarse growth lines. The aperture is vertical, longer than the shell, narrowly arched, dilated above and below, rather effuse anteriorly. Above, the lip rises from the centre of the apical crater and folding back almost covers the perforation; the outer lip is straight and simple; the columella broadly reflexed, emarginate without, tuberculate within, a short tongue of callus extends a little distance upwards along the body whorl. Length $4\frac{1}{2}$, breadth $2\frac{1}{2}$ mm.

One specimen from the lagoon beach.

This species appears to approach nearest to *A. jeffreysi*, Wein-kauff, from the Mediterranean, which served Monterosato as type for his genus *Roxaniella*.

CYLICHNA ERECTA, sp. nov.

(Fig. 46).



Fig. 46.

Shell cylindrical, truncated above, bevelled outwardly round the vertex, rounded below and compressed around the basal axis. Colour white. Sculpture—the only specimen is too worn for exact description; it seems to have been girt by numerous broad and shallow spiral grooves. Aperture nearly perpendicular; lip produced medially; columella broadly reflected, apparently minutely plicated. Spire umbilicate, a shallow crater into which each whorl descends by steps. Length 4, breadth $1\frac{3}{4}$ mm.

A single rather worn example from the lagoon beach.

This species appears to be quite distinct from others of the genus. Those that share the cylindrical shape being *C. discus*, Watson, more truncated anteriorly; *C. protracta*, Gould, three times larger; *C. involuta*, Adams, *C. cylindracea*, Pennant, and *C. alba*, Brown, which appear to have the spire covered. No comparison can be instituted with a mass of unfigured species with which authors (Adams being chief sinner) have oppressed descriptive conchology.

HAMINEA VITREA, *A. Adams.*

Pilsbry, *loc. cit.*, p. 370, pl. xl., fig. 83.

Two specimens from the lagoon beach.

The "Chevert" Expedition took this species in Torres Straits. It occurred to me at Panie, New Caledonia; and under the synonym of *H. tenera*, A. Adams, Melvill and Standen record it from the Loyalties.

CYLINDROBULLA SCULPTA, *Nevill.*

Pilsbry, *loc. cit.*, p. 381, pl. xlii., figs. 36 - 38.

Two living specimens from shallow water in the lagoon, correspond fairly to the above quotation. This Cingalese species has not been noticed before in the Pacific.

AKERA APERTA, *sp. nov.*

(Fig. 47).

Shell small, fragile, transparent, oval. Whorls two and a half, last sloping on the shoulder, then subangled and rounded below; sculptured by close, regular growth lines. Apex truncate. Spire minute, visible through a flat, glossy plate, which continues into a rib bordering the sutural notch. Aperture as long as the shell, much dilated and effuse below, narrowed above to the broad and deep sinus; outer lip arched forward above the middle; columella very concave with a narrow sharply reflexed edge. Length 5, breadth 4 mm.

Three specimens from sand on the lagoon beach.

This curious shell agrees with *Akera* in having the spire at the vertex and in the open aperture, but it approaches *Cylindrobulla* in the more involute spire. I am not satisfied that this may not be the young of the preceding species, but as no information is published on the immature stages of these genera, it seemed well to describe my material, even at the risk of increasing synonymy.

HYDATINA AMPLUSTRE, *Linne.*

Pilsbry, *loc. cit.*, p. 390, pl. xlv., figs. 1 - 6.

An immature specimen from the lagoon beach.



Fig. 47.

So conspicuous a shell is readily observed; Pilsbry quotes Pacific records embracing most archipelagoes between Queensland and Hawaii.

HYDATINA PHYSIS, *Linne.*

Pilsbry, *loc. cit.*, p. 387, pl. xlv., figs. 14, 15, 16, 17.

Mr. G. Sweet found a young shell of this world wide species.

RINGICULA PARVULA, *sp. nov.*

(Fig. 48).

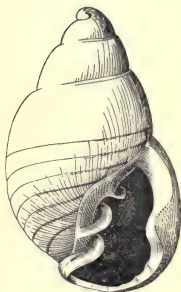


Fig. 48.

Shell very small, broad, solid, milk-white and glossy. Whorls rounded, channelled at the suture; incised by half a dozen sharp narrow grooves at and below the periphery. The mouth armature consists of a large blunt tooth in the middle of the outer lip, an elevated and much compressed one on the body whorl and two others, distant, rounded and oblique on the columella. Length 1.6, breadth 1 mm.

Differs in dentition and contour from *R. mariei*, Morelet, and *R. acuta* v. *minuta*, H. Adams, and in its minute size from all others of the genus.

One specimen from the lagoon beach.

ELYSIA NIGROPUNCTATA, *Pease, var. SANGUINEA, var. nov.*

(Fig. 49).



Fig. 49.

This variety differs from the type figured by Pease or Bergh* by being smaller by one third, and having the tentacles and mantle border coloured a vivid crimson.

One specimen was collected at low water on the extreme outer edge of the windward reef.

Perhaps *E. marginatus*, Pease, is but another colour variety of the same species.

PLECOTREMA BELLUM, *H. & A. Adams.*

Sykes, *Proc. Malac. Soc.*, i., 1895, p. 242.

In reference to this species, Souverbie pathetically remarks that the wretched work of the Adams permits of no precise identification. Their baneful seed has here produced the usual crop of synonymy. My determination of a shell, once collected on

* Pease—*Am. Journ. Conch.*, vi., 1871, p. 304, pl. xxii., fig. 2 a, b, c, d.; Bergh—*Journ. Mus. Godeffroy*, i., 1873, p. 80, pl. ix., fig. 7.

the lagoon beach of Funafuti, rests on a statement by Sykes that *P. bellum* equals *P. souverbiei*, Montrouzier, and upon the illustrations of that, which he omitted to quote.*

The range recorded in the Central Pacific is New Caledonia, Loyalty, Taviuni, Fiji, Paumotus, and Gambier.

PLECOTREMA MORDAX, Dohrn.

Langkavel, Donum Bismarckianum, 1871, p. 30, pl. iii., figs. 8 a. b.

Two specimens from the lagoon beach.

This species, known only from Tahiti and the Paumotus, is perhaps equivalent to the earlier but unfigured *P. striatum*, Philippi.

MELAMPUS FASCIATUS, Deshayes.

Kuster, Conch. Cab., 2nd ed., i., Auriculacea, 1844, p. 33, pl. v., figs. 9–11.

Of this species, Mr. G. Sweet obtained several shells.

The following records from the Central Pacific are quoted by Tapparone Canefri†: New Guinea, New Ireland, New Hebrides, New Caledonia, Fiji, Samoa, Society, and Ellice. Further instances from the Solomons, Queensland, Carolines, Marquesas, and Hawaii, are furnished by this Museum.

MELAMPUS LUTEUS, Quoy & Gaimard.

Kuster, *loc. cit.*, p. 29, pl. vi., figs. 1–3.

Extremely abundant at and above high water-mark, among stones and vegetation.

Tapparone Canefri traces this through the following archipelagoes: New Guinea, New Ireland, New Hebrides, New Caledonia, Samoa, Ellice, Gilberts, Society, and Carolines. Crosse‡ reports it from Woodlark Island on the authority of Montrouzier; and Museum material enables me to add the Solomons.

TORNATELLINA OBLONGA, Pease.

Garrett, Proc. Zool. Soc., 1887, p. 187.

Several living specimens were collected at Funafuti under sticks and stones. Mousson did not record this from the Ellice. "Inhabits," says Garrett, "all the groups from the Marquesas and Paumotus to the Viti Islands."

TORNATELLINA CONICA, Mousson.

Garrett, *loc. cit.*, p. 187.

* Montrouzier—Journ. de Conch., x., 1862, pl. ix., fig. 12; Gassies—Faune Conch. de la Nouvelle Calédonie, 1863, pl. vi., fig. 23.

† Tapparone Canefri—Ann. Mus. Gen., xix., 1883, p. 288.

‡ Crosse—Journ. de Conch., xlii., 1894, p. 323.

Though Græffe found this at Funafuti it escaped my observation. It has the same range as the preceding species, and inhabits the same station.

VERTIGO PEDICULUS, *Shuttleworth*.

Garrett, *loc. cit.*, p. 188.

This widespread species occurred to me at Funafuti as it also did to Græffe.

To the extensive synonymy compiled by Garrett I would suggest the addition of *P. palmyra*, Stol.* and *P. selebensis*, Tapp. Can.†

STENOGYRA GRACILIS, *Hutton*.

Hutton, Journ. Asiat. Soc. Bengal, iii., 1834, p. 93.

Under the synonym of *S. juncea*, Gould, this widespread species has already been recorded from Funafuti. Like Græffe I found it in abundance. A recently described Australian species, *S. interioris*, Tate,‡ seems to me to be synonymous.

ENDODONTA MODICELLA, *Ferussac*.

Pilsbry, Man. Conch. ix., 1894, p. 35.

This widely distributed species is common at Funafuti, where under the name of *E. vicaria*, it has already been recorded by Mousson. To the synonymy arranged by Pilsbry I would add, as the result of study of authentic specimens, *Charopa rotumana*, Smith.§

ENDODONTA DECEMPPLICATA, *Mousson*.

Mousson, Journ. de Conch., xxi., 1873, p. 105.

This species was found by Græffe at Nukufetau and Vaitupu, but was not observed by me at Funafuti.

TROCHONANINA SAMOENSIS, *Mousson*.

Garrett, *loc. cit.*, p. 171; Mousson, *loc. cit.*, p. 104.

I found this common on Funafuti. Græffe took it on Niutao, Vaitupu, Nui, and Nukufetau. Garrett reports it as "common in the Tonga, Cook's, and Samoa Islands, and rare in the Marquesas."

* Stoliczka—Journ. Asiat. Soc. Bengal, xlii., p. 32, pl. iii., fig. 3 a, b.

† Tapperone Canefri—Ann. Mus. Gen. xx., 1883-4, p. 171, pl. i., figs. 12, 13.

‡ Tate—Horn Explor. Exped., Zool., p. 203, pl. xviii., fig. 14.

§ Smith—Ann. Mag. Nat. Hist. (vi.), xx., 1897, p. 520.

EXPLANATION OF PLATE XXIII.

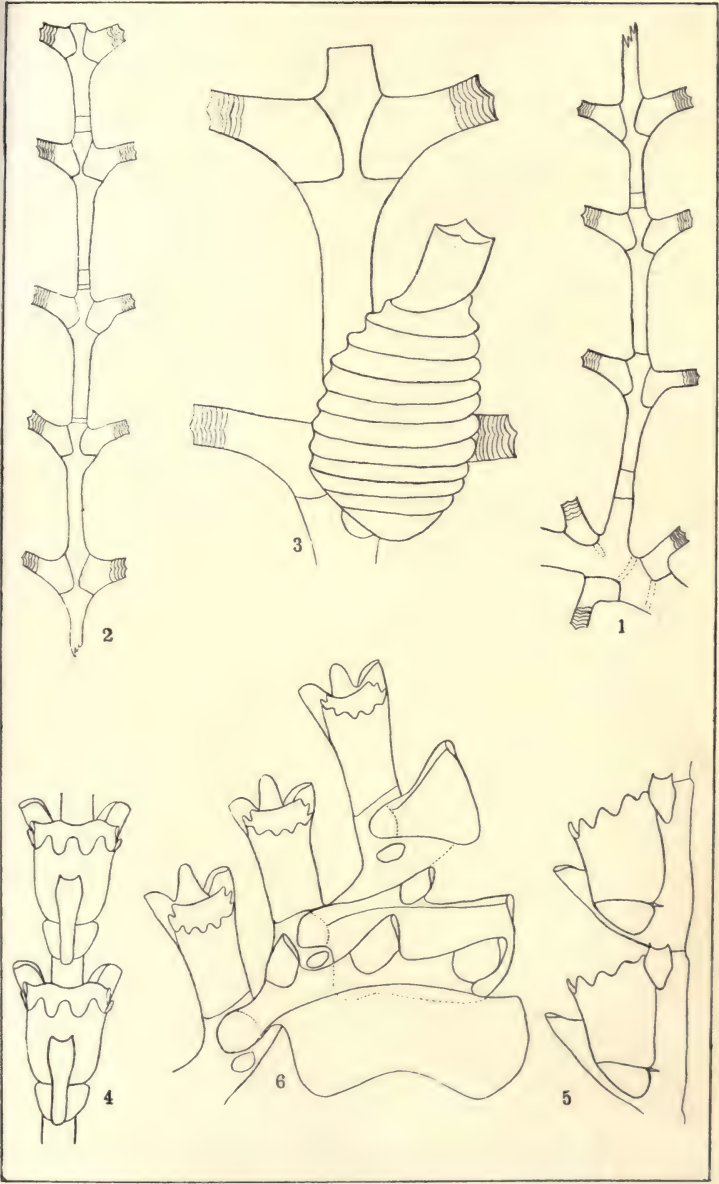
Thuiaria divergens, sp. nov.

- Fig. 1 Portion of main stem, with proximal half of a pinna, magnified.
„ 2 Distal half of pinna, magnified.
„ 3 Portion of pinna with gonangium, highly magnified.

Plumularia clavicula, sp. nov.

- „ 4 Portion of hydrocladium, magnified; front view.
„ 5 Portion of hydrocladium, magnified; lateral view.
„ 6 Distal portion of a corbula, showing the origin of the costa from the mesial sarcotheca.

Reproduced from drawings made by Thomas Whitelegge, Junr.



EXPLANATION OF PLATE XXIV.

Zoanthus funafutiensis, sp. nov.

Fig. 2. Portion of colony. Natural size.

„ 3. Ditto. Enlarged.

Gemmaria willeyi, sp. nov.

Fig. 1. Portion of colony. Natural size.

„ 4. Ditto. Enlarged.

Reproduced from drawings made by Mr. Edgar R. Waite.



1



2



3



4

Edgar Waite, del.

EXPLANATION OF PLATE XXV.

Zoanthus funafutiensis, sp. nov.

- Fig. 1. Transverse section through body-wall. $\times$ 190.
,, 2. Transverse section through œsophageal region.

Lithographed from drawings made by Mr. J. P. Hill.

REFERENCE LETTERS.—c. Cuticle. *ect.* Ectoderm. *ect. c.* Ectodermal canal. *ect. m.* Ectodermal muscle cell. *ent.* Ectoderm. *gr.* Sulcar groove. *incr.* Incrustation. *l.* Lacuna. *m.* Mesoglœa. *m. c.* Mesenteric canal. *m. s.* Mesoglœal sphincter. *n.* Nematocyst. *œs.* Esophagus. *p. m.* Peripheral mesoglœa. *pb. m.* Parieto-basilar muscle. *s. d.* Sulcar directives. *sl. d.* Sulcular directives. *z.* Zooxanthella.

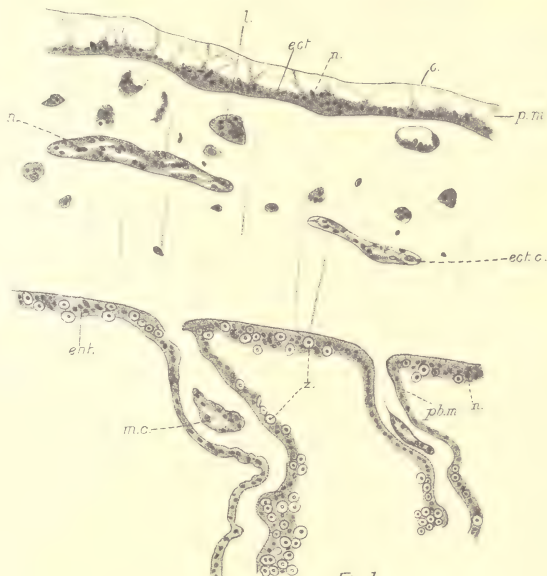


Fig 1.

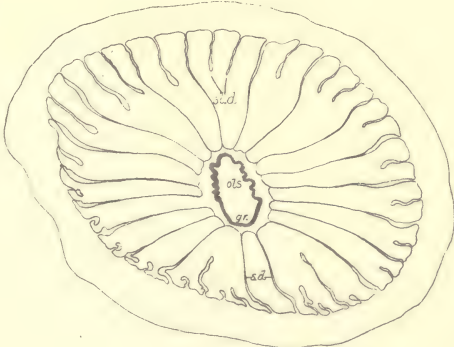


Fig 2.

EXPLANATION OF PLATE XXVI.

Gemmaria willeyi, sp. nov.

- Fig. 1. Transverse section through body-wall. x 100.
„ 2. Vertical section through disc. x 220.

Lithographed from drawings made by Mr. J. P. Hill.

REFERENCE LETTERS.—*c*. Cuticle. *ect*. Ectoderm. *ect. c*. Ectodermal canal. *ect. m*. Ectodermal muscle cell. *ent*. Entoderm. *gr*. Sulcar groove. *incr*. Incrustation. *l*. Lacuna. *m*. Mesogloea. *m. c*. Mesenteric canal. *m. s*. Mesogloal sphincter. *n*. Nematocyst. *oes*. Esophagus. *p. m*. Peripheral mesogloea. *pb. m*. Parieto-basilar muscle. *s. d*. Sulcar directives. *sl. d*. Sulcular directives. *z*. Zooxanthella.



Fig 1.

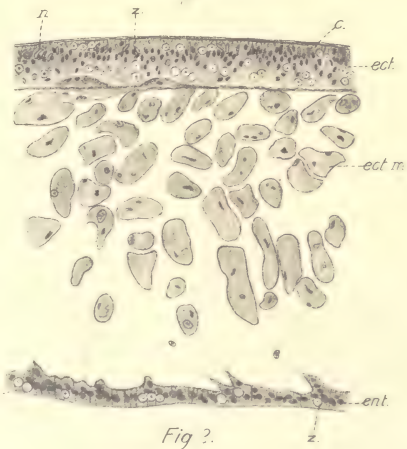


Fig 2.

EXPLANATION OF PLATE XXVII.

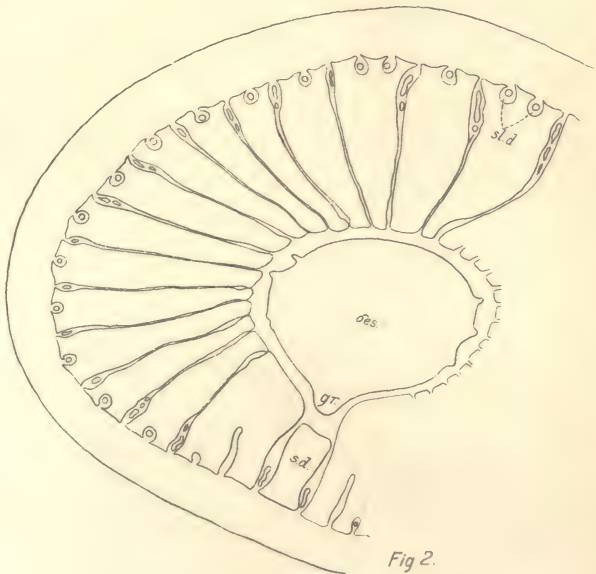
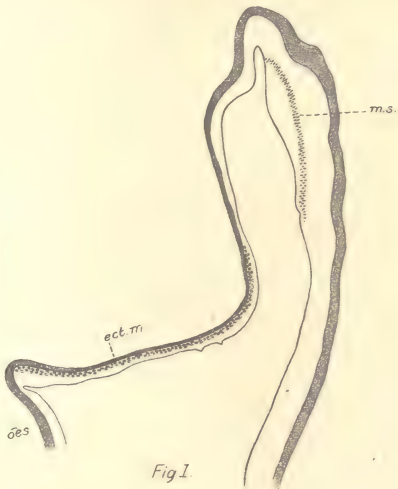
Gemmaria willeyi, sp. nov.

Fig. 1. Vertical section. $\times 28$.

„ 2. Transverse section through œsophageal region. $\times 23$.

Lithographed from drawings made by Mr. J. P. Hill.

REFERENCE LETTERS.—*c*. Cuticle. *ect*. Ectoderm. *ect. c*. Ectodermal canal. *ect. m*. Ectodermal muscle cell. *ent*. Entoderm. *gr*. Sulcar groove. *incr*. Incrustation. *l*. Lacuna. *m*. Mesoglœa. *m. c*. Mesenteric canal. *m. s*. Mesoglœal sphincter. *n*. Nematocyst. *œs*. Œsophagus. *p. m*. Peripheral mesoglœa. *pb m*. Parieto-basilar muscle. *s. d*. Sulcar directives. *sl. d*. Sulcular directives. *z*. Zooxanthella.



THE MOLLUSCA OF FUNAFUTI.

Part II.—Pelecypoda and Brachiopoda.

By CHARLES HEDLEY,

Conchologist, Australian Museum.

[XVIII.]

THE MOLLUSCA.

Part II.—Pelecypoda and Brachiopoda.

By CHARLES HEDLEY,

Conchologist, Australian Museum.

ANOMIA, sp.

A few disassociated upper valves, not specifically recognisable, were gathered on the lagoon beach of Funafuti.

ARCA ZEBRA, *Swainson*.

Reeve, *Conch. Icon.*, ii., 1844, Arca, pl. xi., sp. 69.

Abundant under stones at low water in the lagoon. In this Museum there are specimens from Trinity Bay, Queensland.

It is doubtful whether *A. occidentalis*, Philippi, is distinct. If not, the species has a circumequatorial range.

ARCA MACULATA *Sowerby*.

Reeve, *loc. cit.*, pl. xi., sp. 71.

One living specimen obtained in the lagoon.

First found by Cuming at Marutea, in the Paumotus. Specimens are in this Museum from Aneiteum, New Hebrides.

ARCA RETICULATA, *Gmelin*.

Reeve, *loc. cit.*, pl. xvi., spp. 108, 112 (as *A. divaricata*, Sowerby).

Several disassociated valves of this world-wide species were observed on the lagoon beach.

The synonymy and range of this species have been examined at length by Lischke.*

ARCA VELATA, *Sowerby*.

Reeve, *loc. cit.*, pl. xii., sp. 79.

Common in blocks of coral in shallow water in the lagoon.

First obtained at Marutea, Paumotus, by Cuming.

* Lischke—Japan Meeres conchylien, ii., 1871, p. 142, iii., 1874, p. 107. Smith adds *A. dubia*, Baird, to the list—Proc. Zool. Soc., 1891, p. 431. Further notes will be found in the Proc. Linn. Soc. N.S.W. (2), ix., 1894, p. 180; Trans. Roy. Soc. S.A., xix., 1895, p. 261; and Trans. Wagner Free Inst. Sci., iii., 1898, p. 628.

ARCA TENELLA, Reeve.

Reeve, *loc. cit.*, pl. xiv., sp. 91.

One living and one dead specimen were taken in the lagoon.

SEPTIFER EXCISUS, Wiegmann.

Reeve, *Conch. Icon.*, x., 1857, *Mytilus*, pl. iv., sp. 13.

Separate valves were common on the lagoon beach. I once found it alive in a block of perforated dead coral. This species does not seem to have been reported from the Pacific.

MODIOLA AUSTRALIS, Gray.

Reeve, *loc. cit.*, *Modiola*, pl. v., sp. 21.

Attached to coral blocks in the lagoon.

The species I thus identify has a wide range. It occurs along the Australian coast south to Sydney. Museum examples show it from the Gilberts, Lifu, and New Caledonia.

LITHOPHAGA TERES, Philippi.

Reeve, *loc. cit.*, *Lithodomus*, pl. iii., sp. 13.

Abundant ; boring coral with the following species.

Schmeltz records it from Rarotonga, and Smith from Bowen, Queensland. It is in this Museum from Port Molle and Port Curtis, Queensland ; and New Caledonia.

LITHOPHAGA LEVIGATA, Quoy & Gaimard.

Quoy and Gaimard, *Voy. "Astrolabe," Zool.* iii., 1835, p. 464, pl. lxxviii., figs. 17, 18.

Abundant at low water level, boring in coral blocks in the lagoon.

This species has been omitted from the Monographs of Reeve and Dunker, and indeed from subsequent literature generally. From the account quoted above, I have little doubt that it is the species commonly known as *Lithodomus malaccanus*, Reeve. It is a usual companion of the previous species. Under Reeve's name, Schmeltz quotes it from Tahiti, and Smith from Torres Straits. It is in this Museum from New Caledonia, and Tupuselei, British New Guinea.

PLICATULA IMBRICATA, Menke.

Sowerby, *Thesaurus Conch.*, i., 1847, p. 437, pl. xc., fig. 6, pl. xci., figs. 15-18.

A few small specimens found alive in shallow water in the lagoon, adhering to dead shells, are with doubt so identified.

SPONDYLUS OCELLATUS, Reeve.

Reeve, Conch. Icon., ix., Spondylus, 1856, pl. xii., sp. 43.

An odd and worn valve from the lagoon beach is referred to this species.

Melvill and Standen report it from Lifu.

LIMA BULLATA, Sowerby.

Sowerby, Thes. Conch., i., 1847, p. 84, pl. xx., figs. 32, 33.

A single valve of a young individual is ascribed to this species, which ranges along the east Australian coast to Tasmania.

LIMA TENERA, Chemnitz.

Sowerby, *loc. cit.*, p. 84, pl. xxi., figs. 2, 3, 10, 11, 13.

One valve, apparently the young of this species, was obtained by tangles at forty to eighty fathoms.

Pacific localities for this species, noted in the "Challenger" Report, are Fiji, and Sir C. Hardy Island, off North Queensland. Melvill and Standen mention it from Lifu.

LIMA SQUAMOSA, Lamarck.

Sowerby, *loc. cit.*, p. 84, pl. xxi., figs. 1, 18.

This world-wide species occurred alive in the lagoon.

LIMA ANGULATA, Sowerby.

Sowerby, *loc. cit.*, p. 86, pl. xxii., figs. 39, 40.

Several small specimens were found alive under stones in the lagoon.

Smith unites* with this *L. basilanica* and *L. orientalis*, both of Adams and Reeve, and *L. fasciata*, Sowerby (not Linne).

LIMA FRAGILIS, Gmelin.

Sowerby, *loc. cit.*, p. 86, pl. xxii., figs. 34–37.

Small specimens were of frequent occurrence under stones in the lagoon.

Sowerby records this from Tahiti; Von Martens† from New Guinea and the Gilberts; and Smith‡ from Port Essington, Port Molle, Torres Straits, and Fiji. It is in this Museum from New Caledonia and Queensland.

PECTEN SQUAMATUS, Gmelin.

Reeve, Conch. Icon., viii., 1853, pl. xxi., fig. 82.

A few broken valves were collected on the beach of the lagoon.

* Smith—Chal. Rep., Zool., xiii., 1885, p. 289.

† Von Martens—Journ. Linn. Soc., Zool., xxi., 1889, p. 202.

‡ Smith—Zool. Coll. "Alert," 1884, p. 116.

PECTEN PALLIUM, *Linne.*

Reeve, *loc. cit.*, pl. xvii., fig. 63.

One valve from the lagoon beach.

This species appears to be widespread through the tropical Pacific. Cuming found it at Marutea, Paumotu. It is represented in this Museum from San Christoval, Solomons; Erromanga, New Hebrides; New Caledonia; Tonga; and the Gilberts.

P. novæ-guineæ, T. Woods, a Pleistocene fossil from Hall Sound, British New Guinea, is reduced to a synonym of *P. pallium* by Prof. R. Tate.

PECTEN DISTANS, *Reeve.*

Kobelt, *Conch. Cab.*, Pecten, 1885, p. 228, pl. xli., fig. 2.

One valve from the lagoon beach.

New Caledonian specimens occur in the Museum series.

PECTEN MADREPORARUM, *Sowerby*

Sowerby, *Thesaurus Conch.*, i., 1847, p. 68, pl. xiv., fig. 68.

One specimen from the lagoon beach.

Also represented in the Museum from Hood Lagoon and Tupuselei, British New Guinea; Cape York, Queensland; and New Caledonia. This species appears to be universally but erroneously ascribed to Petit. It is a perverse fate which credits an author, who was the first to energetically protest against manuscript names,† with indulging in the practice himself. Sowerby's locality, the Red Sea, as well as his authority, requires confirmation.

HINNITES, *sp.*

Attached to sheets of dead coral, and associated with the Brachiopod *Thecidea maxilla*, were several adherent valves of a species of *Hinnites*, too imperfect for specific determination.

PTERIA PEASEI, *Dunker.*

Dunker, *Conch. Cab.*, *Avicula*, 1872, p. 24, pl. viii., fig. 1.

Attached (as mentioned *ante* p. 308) in great numbers to the branches of *Plexaura antipathes*.

The species was described by Pease‡ under the thrice pre-occupied name of *Avicula radiata*, from the Gilberts. Schmeltz, who considers *A. cypsellus*, Dunker, a synonym,§ reports it from Samoa.

PTERIA CUMINGII, *Reeve.*

Reeve, *Conch. Icon.* x., 1857, *Avicula*, pl. iv., sp. 6.

* Tate—*Proc. Linn. Soc. N.S.W.* (2), ix., 1894, p. 214.

† Petit—*Revue Zool.*, ii., 1839, p. 346, and iii., 1840, p. 154.

‡ Pease—*Proc. Zool. Soc.*, 1862, p. 244.

§ Schmeltz—*Mus. Godeffroy Cat.*, v., 1874, p. 176.

This species is employed on Funafuti in the manufacture of fish-hooks (*ante* p. 268). I purchased a valve from a native on Nukulailai.

Cuming procured the type at Marutea, Paumotu.

MELINA SAMOENSIS, *Baird*.

Baird, in Brenchley, Cruise of the "Curaçoa," 1873, p. 454, pl. xlii., fig. 8.

Common; attached to the under surfaces of coral blocks on the ocean beach of Funafuti, at low water. My specimens exceed the type in size, being upwards of 50 mm. in length.

I suspect that the prior *P. lingueformis*, Reeve, from the Society Islands, is but a depauperated form of this. The "Challenger" collected *M. samoensis* on the reefs at Honolulu and Hawaii; the type came from Tutuila, Samoa.

Both Meek and Dall have pointed out* that the name of *Perna* must be superseded by that of *Melina*.

PINNA, sp.

Some fragments of a *Pinna*, perhaps *P. trigonalis*, Pease, were seen on the lagoon beach of Funafuti.

OSTREA HANLEYANA, *Sowerby*.

Sowerby, Conch. Icon., xviii., 1871, Ostrea, Pl. xxviii., sp. 72.

An oyster which occurred under stones beside *M. samoensis* is with much doubt so identified.

OSTREA CRISTAGALLI, *Linne*.

Sowerby, *loc. cit.*, pl. xi., sp. 22.

Obtained in eighteen fathoms, three miles south-west of the village (*ante* p. 328).

I collected this at Port Moresby, British New Guinea. It is represented in this Museum from Florida, Solomons; Havannah Harbour, New Hebrides; and Ouvea, Loyalties.

CARDITA SWEETI, sp. nov.

(Fig. 50).

Shell solid, oblong, slightly oblique, inequilateral, little inflated. Colour dull white, upon the beak pale yellow. Sculptured by about forty-five close, raised, radiating ribs, separated by deep interstices a quarter of their width. In the median area the rays are smaller and closer together than at the sides, while at the extremities they rapidly enlarge and rather recurve. Upon

* Meek—Report U.S. Geol. Survey Territories, ix., 1876, p. 28, note; Dall—Trans. Wagner Free Inst. Sci., iii., 1898, p. C65.

the rays are crowded small transverse lunate gemmules. Lunule sharply impressed, narrow, lanceolate. Ligament large, external.

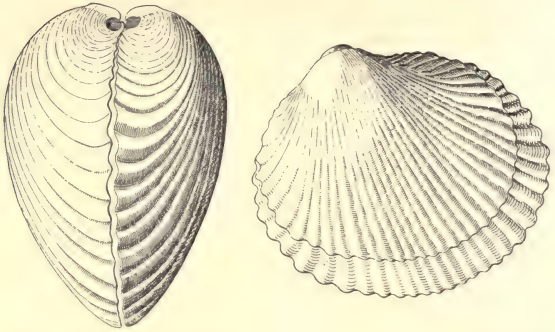


Fig. 50.

Hinge line short, straight, remainder of the margin evenly rounded. Internal margin sharply, finely crenulated. Length 14, breadth 12, diameter of conjoined valves 8 mm.

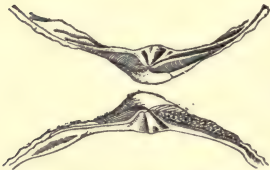


Fig. 50.

One entire shell, described above, was taken by Mr. G. Sweet; and a single, worn, slightly larger valve, by myself at Funafuti.

This species seems nearest to *C. dilecta*, Smith, but is distinguished from that and other members of the genus by more numerous ribs bearing closer packed grains.

The specific name is in compliment to Mr. G. Sweet, the finder, who was a member of the second expedition to Funafuti.

The side view is drawn to a smaller scale than the other sketches.

LUCINA EXASPERATA, *Reeve*.

Reeve, Conch. Icon., vi., 1850, *Lucina*, pl. i., sp. 4.

A few specimens from the lagoon.

Melvill and Standen notice this from Lifu. It is in this Museum from New Caledonia.

LUCINA PUNCTATA, *Linne*.

Pfeiffer, Conch. Cab., Veneracea, 1869, p. 262, pl. xix., figs. 8, 9.

One specimen from the lagoon beach.

Reported by Schmeltz from Samoa, Fiji, and Rarotonga; by Melvill and Standen from Lifu; and represented in this Museum from New Caledonia.

LUCINA DIVERGENS, *Philippi*.

Reeve, Conch. Icon., vi., 1850, *Lucina*, pl. vii., spp. 33, 37, 38.

Common on the lagoon beach.

Prof. von Martens has pointed out* that Philippi's name enjoys two month's priority over the better known *L. fibula*, of Reeve. He refers to it from Samoa and Fiji, and Melvill and Standen from Lifu. Material in this Museum show it to extend south along the Australian coast to Newcastle, New South Wales, and also to the Ladrões, New Hebrides, and New Caledonia.

LUCINA OBLONGA, sp. nov.

(Fig. 51).

Shell small, but thick and strong, ovate, very inequilateral, inflated. Colour, one specimen is white, the other pink. Sculpture—the umbones are smooth, the remainder closely and rather

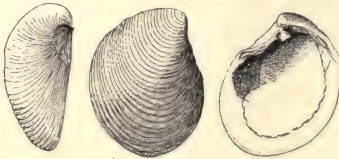


Fig. 51.

irregularly covered with numerous, raised, strong, concentric, ribs, narrower than their interstices; faint radiating sculpture is barely visible in these interstices. Beaks prominent and much incurved. Lunule large, sharply impressed, sculptured by a faint continuation of the concentric ribs. Dorsal surface wanting the depression which characterises *L. seminula* and its allies. Interiorly the margin is most minutely crenulated. Length 3; height 3.75 mm.

Two valves from the lagoon beach.

Allied to *L. congenita*, Smith,† from which it differs by being narrower in proportion to height, more densely ribbed, and more inequilateral.

CORBIS FIMBRIATA, *Linne*.

Sowerby, Conch. Icon., xviii., 1872, *Corbis*, pl. i., sp. 1.

A living specimen occurred under blocks of coral in the lagoon.

Schmeltz quotes this from Fiji and the Pelews; Melvill and Standen from Lifu. It is in this Museum from Port Curtis, Queensland; New Caledonia; and Tonga.

* Von Martens—Journ. Linn. Soc., Zool., xxi., 1889, p. 209.

† Smith—Chall. Rep., Zool., xiii., 1885, p. 182, pl. xiii., figs. 7, 7a.

CRYPTODON GLOBOSUM, *Forsk.*

Reeve, Conch. Icon., vi., 1850, pl. v., sp. 21 (as *L. ovum*).

Common as dead shells on the lagoon beach.

Ranges along the east Australian coast south to St. Vincent's Gulf. Is represented in this Museum from Tonga.

TELLINA RUGOSA, *Born.*

Sowerby, Conch. Icon., xvii., Tellina, 1866, pl. ix., sp. 36.

A few dead, subfossil valves were picked up around the raised *Heliopora* reef.

Reported by H. Cuming from Rapa, Austral Islands; by Melvill and Standen from Lifu; and by Schmeltz from Samoa, Fiji, Rarotonga, and Tahiti. In this Museum it is represented from Moreton Bay, Queensland; Pipon Islands, New Caledonia; Tonga; and Hawaii.

TELLINA SCOBINATA, *Linne.*

Sowerby, *loc. cit.*, pl. xiv., sp. 64.

Common on the lagoon beach.

Sowerby notes this from the Society Islands; Schmeltz from Samoa, Fiji, and Rarotonga; Melvill and Standen from Lifu. This Museum contains it from the Solomons, Gilberts, and Tonga.

TELLINA FLAMMULA, *Deshayes.*

Sowerby, *loc. cit.*, pl. lii, sp. 310.

A few valves from the lagoon beach.

Included in the Museum collection from Woodlark Island and New Caledonia.

TELLINA DISPAR, *Conrad.*

Sowerby, *loc. cit.*, pl. iii., sp. 10.

A few separate valves were noticed on the lagoon beach.

First described from Hawaii; noted by Schmeltz from Upolu and Tahiti; and by Melvill and Standen from Lifu. Represented in this Museum from Port Curtis and Moreton Bay, Queensland; and New Caledonia.

TELLINA OBLIQUARIA, *Deshayes.*

Sowerby, *loc. cit.*, pl. liv., sp. 321.

Several specimens from the beach of the lagoon, some rose, others lemon, others again lemon with rose stripes from the umbo.

Deshayes, in his original description,* records this species from the Pacific Ocean. Sowerby, in the reference quoted above,

* Deshayes—Proc. Zool. Soc., 1854, p. 356.

though actually mentioning the page of his predecessor's work, states that the habitat of the species is unknown. Such evidence of carelessness supports me in concluding that Sowerby again described this species as *T. obliquistriata*,* from "Kingsmill Island," by which the Kingsmill or Gilbert Group are doubtless intended. It is in this Museum from Aneiteum, New Hebrides.

TELLINA RHOMBOIDES, Quoy & Gaimard.

Smith, Chall. Rep., Zool., xiii., 1885, p. 103.

Abundant in the lagoon.

Reported by Smith, under various names, from Guam in the Ladrões; Cape York, Queensland; and Levuka, Fiji; and by Melvill and Standen from Lifu. It is in this Museum from Aneiteum, New Hebrides.

TELLINA ROBUSTA, Hanley.

Sowerby, *loc. cit.*, pl. xvi., sp. 77.

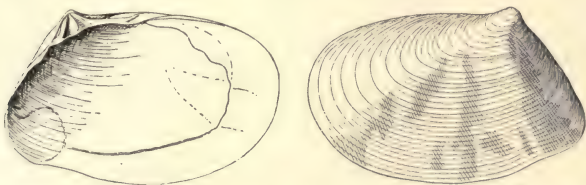
The yellow variety occurred in profusion in the lagoon.

Hanley reports this from Anaa, Paumotu; Schmeltz from Tahiti, Rarotonga, and Upolu. I have taken it at Hyenghien, New Caledonia. There are examples in the Museum from the Isle of Pines.

TELLINA OPALINA, Sowerby.

(Fig. 52).

Sowerby, *loc. cit.*, pl. xliv., sp. 258.



The paucity of information given by Sowerby permits no accurate determination, but suggests this name for a species of which I took a dozen odd valves on the beach of the lagoon. The species in question is in length 5.5, and in height 3.7 mm.; very glossy, radiately marked with translucent and opaque lines or dashes, the concentric sculpture almost effaced.

The original description gave no locality. Melvill and Standen supply† Madras and the Moluccas.

* Sowerby — Conch. Icon., xvii., 1866, pl. xlv., sp. 256.

† Melvill and Standen — Journ. Conch., ix., 1898, p. 85.

TELLINA FIJIENSIS, Sowerby.

Smith, *loc. cit.*, p. 107.

A few separate valves from the lagoon beach.

Previously reported from Marutea, Paumotus ; and Ngau and Levuka, Fiji.

TELLINA CREBRIMACULATA, Sowerby.

Sowerby, *loc. cit.*, pl. li., sp. 301.

A few separate valves from the lagoon beach.

Hitherto only recorded from Fiji.

TELLINA ELLICENSIS, sp. nov.

(Fig. 53).

Shell small, very solid, opaque, very inequilateral, rather inflated anteriorly, height two-thirds of the length, truncate posteriorly. Colour white, irregularly painted with small rose spots and streaks. Sculptured over the entire surface by fine, close, concentric threads.

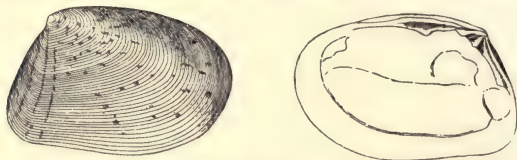


Fig. 53.

Umbo prominent. Fold almost obsolete. Dorsal margin straight, then curved anteriorly. Anterior margin curved the third of a circle. Ventral margin nearly straight, scarcely sinuated by the fold. Hinge composed of two cardinal teeth, a strong anterior lateral and a weaker posterior lateral tooth. Length 6, height 4 mm.

This species is allied by sculpture and contour to *T. tenuilirata*, Sowerby, from which a much shorter, broader outline clearly separates it.

One right valve was found on the beach of the Funafuti lagoon.

LIBITINA GUINAICA, Lamarck.

Reeve, *Conch. Icon.*, i., Cypricardia, 1843, pl. ii., species 13.

Plentiful dead on the beaches ; once found alive in a crevice in a block of coral in the lagoon.

The only other Pacific record seems to be the finding of it by Hugh Cuming at Marutea, Paumotus.

CIRCE PECTINATA, Linne.

Römer, Mon. Veneridæ, i., 1869, p. 174, pl. xlvii, figs. 1a-d.

Common in the Funafuti lagoon; collected alive among loose rocks.

Römer quotes this from Marutea, Paumotus; Fischer from New Caledonia; Schmeltz from Bowen, and Smith from Thursday Island, Queensland. It is in this Museum from Fiji; Port Moresby, British New Guinea; and Port Curtis, Queensland.

CIRCE PICTA, Lamarck.

Römer, *loc. cit.*, p. 164, pl. xlv., fig. 3.

Two valves from the lagoon beach.

Smith states* that the distinction between this and several admitted species is obscure. Schmeltz quotes it from Upolu, Samoa; and Melvill and Standen from Lifu.

CIRCE CASTRENSIS, Linne.

Römer, *loc. cit.*, p. 159, pl. xlv.

A few valves were found on the lagoon beach.

Smith has recorded this from Bowen, Queensland. In this Museum it is represented from New Caledonia; the Loyalties; Aneiteum, New Hebrides; Guadalcanar, Solomons; and Tongatabu, Tonga.

CYTHAREA OBLIQUATA, Hanley, var. PRORA, Conrad.

Römer, *loc. cit.*, p. 107, pl. xxix., fig. 1, pl. xxxiii., figs. 4, 5.

Very common on the lagoon beach.

Schmeltz quotes this from Fiji, Tahiti, and Rarotonga. The Museum series show it from Port Curtis, Queensland; and New Caledonia.

CYTHAREA SUBPELLUCIDA, Sowerby.

Römer, *loc. cit.*, p. 112, pl. xxx., fig. 4.

One specimen from the lagoon beach.

VENUS TOREUMA, Gould.

Reeve, Conch. Icon., xiv., 1863, Venus, pl. xvi., sp. 64.

Several valves from the lagoon beach.

Smith records this from Port Molle and Port Curtis, Queensland. Other Queensland localities shown by the Museum collection are Torres Straits, Bowen, and Moreton Bay.

* Smith—*Loc. cit.*, p. 146.

VENUS PUERPERA, L., var. LISTERI, Gray.

Reeve, *loc. cit.*, pl. v., sp. 14.

Several adult valves were taken on the lagoon beach; and what seems a very young shell was caught by the tangles in forty to eighty fathoms on the western slope of the atoll.

VENERUPIS MACROPHYLLA, Deshayes.

Sowerby, *Thes. Conch.*, ii., 1855, p. 763, pl. clxv., fig. 20.

One small specimen taken boring dead coral in the lagoon.

NARANIO LAPICIDA, Chemnitz.

Sowerby, *Thes. Conch.*, ii., 1855, p. 776, pl. clxvi., fig. 26.

Found boring loose coral blocks in the lagoon.

Schmeltz quotes this from Yap, Pelews. Sowerby mentions it from Australia; though no doubt it occurs on the Great Barrier Reef, I am not acquainted with Australian examples of the typical form with posterior radiating ribs. A thinner, smoother form, (*var. divaricata*) has been noticed in South Australia. A useful index to the genus is given by Tryon.*

KELLIA PACIFICA, sp. nov.

(Fig. 54).

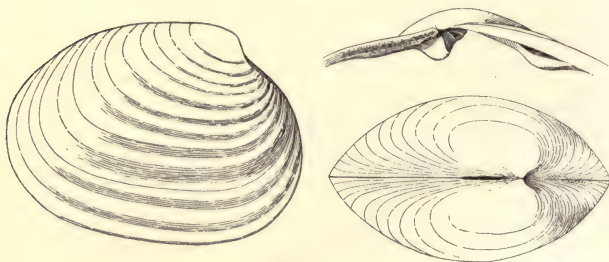


Fig. 54.

Shell oblong, inflated, most glossy, iridescent by reflected light. Equivalve, margins closed. Inequilateral to the extent of the posterior being twice the length of the anterior. Colour milky on the umbones, cream on the ventral margins, with concentric opaque and translucent zones. Sculptured by delicate unequal growth lines which grow coarser with age. Beaks small, almost touching, forwardly directed. Ventral margin straight, anteriorly truncated, posterior rounded and dorsal gently curved.

* Tryon—*Am. Journ. Conch.*, vii., 1872, p. 258.

Length 11, height 8, breadth of conjoined valves 5.5 mm.

Alive in the lagoon under loose blocks of dead coral. There is a specimen of this species in this Museum from New Caledonia, labelled by Mr. E. A. Smith, "*Scintilla ovulina*, Desh.," with the description and figure of which it does not agree.

SCINTILLA SEMICLAUSA, Sowerby.

Sowerby, Conch. Icon., xix., *Scintilla*, 1874, pl. ii., sp. 9.

One specimen alive in shallow water in the lagoon.

Recorded by Melvill and Standen from Lifu.

ATACTODEA STRIATA, Gmelin.

(Fig. 55).

Reeve, Conch. Icon., viii., *Mesodesma*, 1854, pl. ii., sp. 10.

Abundant alive in sand at low water along the margin of the lagoon. It was eaten by the children who called it "assouri." An enlarged drawing taken from life on the spot is here reproduced. The animal is extremely bold and active, it is cream colour with a vivid scarlet border to the anterior edge of the mantle.

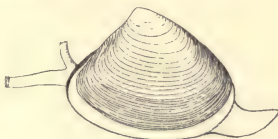


Fig. 55.

Unless slight difference of sculpture be regarded as of specific distinction, this species is shown by Museum material, under various names from Port Curtis, Eclipse Island, Queensland; Guam, Ladrones; Teste Island, Louisiade Archipelago; the Solomons; New Hebrides; Fiji; and Samoa.

ASAPHIS DEFLORATA, Linne.

Reeve, Conch. Icon., x., *Capsa*, 1856, pl. i.

This species is abundant on the Funafuti lagoon.

Reeve reports it from Tahiti, and Melvill and Standen from Lifu. It is represented in this Museum from Torres Straits and Port Curtis, Queensland; Woodlark Island, British New Guinea; Vate, New Hebrides; New Caledonia; and the Gilberts.

PSAMMOBIA SQUAMOSA, Lamarch.

Reeve, Conch. Icon., x., 1857, *Psammobia*, pl. vii., sp. 50.

One young and separate valve from the lagoon beach.

CARDIUM ANGULATUM, Lamarch.

Reeve, Conch. Icon., ii., 1845, *Cardium*, pl. xiv., sp. 70.

Single valves are not uncommon on the lagoon beaches.

Specimens of this species are contained in this Museum from New Caledonia and Uea or Wallis Island. It is represented by the above quoted illustration, and is also identical with specimens returned from the British Museum under the name of "*Cardium philippinense*, Deshayes"; this name I have been unable to trace in literature.

CARDIUM MACULOSUM, Wood.

Reeve, *loc. cit.*, pl. xvi., sp. 76.

A few separate valves were found on the lagoon beach.

CARDIUM CARDISSA, var. *DIONÆUM*, Sowerby.

Reeve, *loc. cit.*, pl. xxi., sp. 122.

Common on the lagoon beach.

This was first collected by Cuming on Anaa, Paumotus.

CARDIUM FRAGRUM, Linne.

Reeve, *loc. cit.*, pl. iv., sp. 23.

Common in the lagoon.

It is represented in this Museum from Port Curtis, Queensland, and New Caledonia.

C. FRAGRUM, var. *SUEZIENSE*, Issel.

Smith, Chall. Rep., Zool., xiii., 1885, p. 158, pl. viii., figs. 2, 2a, 2b.

Separate valves were abundant on the lagoon beach, and one was obtained outside the atoll at a depth of eighty to forty fathoms.

The four dozen odd valves before me exhibit much variation in contour, and they appear to pass by gradual transition into typical *C. fragrum*. Smith, who redescribes and refigures the species, rests his definition chiefly on form. The figure of Issel,* which he condemns, can in outline be exactly matched by Funafuti material. Possibly the species tends in deeper water to assume this form. The "Challenger" dredged it off Fiji, and this Museum possesses examples from Torres Straits.

TRIDACNA GIGAS, L., var. *SQUAMOSA*, Lamarck.

Reeve, Conch. Icon., xiv., Tridacna, 1862, pl. iii.

Not uncommon among the reefs of the lagoon.

Known to the natives of Funafuti as "*Fasua tuka*," (*ante* p. 67) and by them, as by other South Sea Islanders, esteemed for food.† It had a further economic value as material for ornaments and

* Issel—*Malacologia del Mar Rosso*, 1869, pl. iii., fig. 4.

† Hedley in Thomson—*British New Guinea*, 1892, p. 283.

axe heads.* The natives of the Solomon Islands prefer fossil to recent shells for this purpose.†

What information we have, suggests that the range of this species is almost co-extensive with that of the reef-building corals.

Weights and measures of sundry large individuals have lately been published by Smith,‡ his maximum record being five hundred and seven pounds weight, and fifty-four inches in length. This is almost reached by an unquoted record from the Isle of Pines, New Caledonia. Dr. T. Mialaret writes§:—"In the middle of the peninsula which encloses the Bay of Oupi on the east, there occurs, sunk in the coral, the edges of its valves level with the surface of the rock, a gigantic *Tridacna* measuring at least 1 metre 20 in length. At the request of Admiral Courbet, we attempted in 1882 to extract it, but all our efforts were in vain."

The genus *Tridacna* appears to suffer from a superfluity of specific names. No characters of permanent value separate *T. squamosa* from *T. gigas*. These forms are usually if not invariably free.|| On the contrary, the habit of *T. elongata* is to bury itself in rock, a habit always causing variability in shape.

Hanley states that it was upon what Lamarck called "*T. squamosa*" that Linne himself founded his *Chama gigas*.¶

TRIDACNA ELONGATA, Lamarck.

Reeve, *loc. cit.*, pl. ii. ; Valliant, *Ann. Sci. Nat.*, iv., 1865, pp. 65 - 172, pls. viii. - xii.

This species is abundant, perforating dead coral in the Funafuti lagoon. So firmly does the foot adhere, that when wrenching the shell out of its burrow, I have sometimes torn the animal asunder, leaving the foot attached to the rock. The position of the shells embedded in dead coral is well displayed in one of W. S. Kent's photographs.**

The natives, who distinguish it from the preceding as "*Fasua noa*," also use it as food.

The range of *T. elongata* appears to exceed that of *T. gigas*, the furthest southern point reached by it in the Pacific being Lord Howe Island.

* Valliant—*Bull. Soc. Geol. Fr.*, xxv., 1868, pp. 681 - 687.

† Willey—*Nature*, Oct. 1896, p. 523.

‡ Smith—*Proc. Malac. Soc.*, iii., 1898, p. 112.

§ Mialaret—*L'Ile des Pins, son Passé, son Present, son Avenir*, 1897, p. 63.

|| Kent—*Great Barrier Reef*, 1893, pp. 44 - 45, pl. xxix.

¶ Hanley—*Ipsa Linnæi Conchyliæ*, 1855, p. 85.

** Kent—*Loc. cit.*, foreground of No. 1, pl. iv.

CHAMA IMBRICATA, *Broderip*.

Broderip, Trans. Zool. Soc., 1835, p. 304, pl. xxxix., fig. 2; Lischke, Jap. Meeres Conch., ii., 1871, p. 126, pl. ix., fig. 4.

Chama foliacea, Quoy and Gaimard, Voy. "Astrolabe," Zool., iii., 1835, p. 478, pl. lxxviii., fig. 19.

Abundant at low water in the Funafuti lagoon, a mile south of the village.

The foliations on the opercular valve are in my specimens all worn away, and for identification I have relied on the contour, the dark purple stain on the upper interior margin, and the absence of marginal crenulations. The *C. foliacea*, Q. & G., from Vanikoro, appears to me to be identical. As Broderip's preliminary description* did not appear till April 3rd, 1835,† I do not know whether it was in London or in Paris that the species was first published.

Hugh Cuming brought the type from Marutea, Paumotus; Melvill and Standen note it from Lifu. An example from Aneiteum, New Hebrides, is in this Museum.

CHAMA SPINOSA, *Broderip*.

Broderip, *loc. cit.*, p. 306, pl. xxxviii., figs. 8, 9.

Two specimens from the lagoon.

If I have correctly identified this species, the upper valve must have always been wrongly drawn. In a specimen before me, the umbo is at a third of the diameter of the valve from the hinge, and around it the valve has performed three spiral volutions.

Found by Cuming at Marutea, Paumotus.

CHAMA UNICORNIS, *Bruguiera*.

Clessin, Conch. Cab., Chama, 1888, p. 15, pl. ii., figs. 3, 4.

With doubt I so identify, from insufficient figures and description, a specimen with two revolutions, 15 mm. long from Funafuti.

CORBULA TAHEITENSIS, *Lamarck*.

Reeve, Conch. Icon., ii., Corbula, 1843, pl. ii., sp. 15.

One of the most abundant shells on the lagoon beach, but I did not meet with it alive.

To the original locality of Tahiti, Smith adds that of New Guinea.‡

GASTROCHÆNA LAMELLOSA, *Deshayes*.

Smith, Chall. Rep., Zool., xiii., 1885, p. 28, pl. vii., figs. 2, 2b.

Found alive, boring in coral blocks, in the lagoon.

* Broderip—Proc. Zool. Soc., 1834, p. 149.

† See Sclater—Proc. Zool. Soc., 1894, p. 436.

‡ Smith—Proc. Zool. Soc., 1891, p. 430.

Smith reports this from Torres Straits. In this Museum it is represented from Fiji; New Caledonia; Moreton Bay, Queensland; and St. Vincent's Gulf, South Australia.

NAUSITORIA AURITA, sp. nov.

(Fig. 56).

Shell distinguished by an auricle which is much recurved outwards and above; within, it is raised above the surface of the valve. This character is illustrated by Fig. 56, showing exterior and interior of the right valve. Ventral or median area rather broad. Apophyses short and broad. Hinge tubercle bifid. Length 9, breadth 9 mm. Palettes unknown.

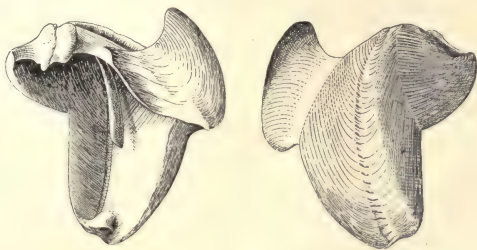


Fig 56.

A log, recognised by a bushman of our party as kauri (*ante* p. 40) which came ashore at Funafuti, had been bored by this mollusc. On breaking the wood up with an axe, I found the only vestiges left of the animal to be a pair of valves broken at the ventral tips, which I found in a burrow.

Mr. R. C. Rossiter afterwards generously presented me with a couple of perfect valves, specifically identical with these Funafuti shells, which he collected at Noumea, New Caledonia.

An ally of this seems to be a species of unknown origin named by Sowerby *Teredo campanulata*, that is however apparently narrower in the ventral portion, and even more produced and recurved in the auricle.

I recently examined* certain Australian shipworms, and remarked that they differed from *Teredo* generically. For their reception I selected the genus *Calobates*, Gould (1862), revised the characters of that genus, and subordinated to it *Nausitoria*, Wright (1864), and *Lyrodus*, Gould (1870). It unfortunately escaped my attention that Tapparone Canefri had already pointed out† that *Calobates*, as a generic term, had been twice preoccupied

* Hedley—Proc. Linn. Soc. N.S.W., xxiii., 1898, p. 91.

† Tapparone Canefri—Ann. Mus. Civ. Genoa, ix., 1877, p. 290.

for birds, and was therefore inadmissible. He proposed to substitute *Bactronophorus*, Tapparone Canefri (1877). As, however, the prior name of *Nausitoria* is available, that must come into use when *Calobates* is abandoned.

The Teredinidæ have been unfortunate in their monographers. The account in the last volume of the *Conchologia Iconia*, by Sowerby, is a slovenly production and full of errors. Even worse is an alleged Monograph by Clessin in the *Conchylien Cabinet*, of which the text and illustrations disgrace that serial. The latter memoir is absolutely the worst zoological monograph I have read.

POROMYA GRANULATA, Nyst & Westendrop.

Forbes and Hanley, *British Mollusca*, i., 1853, p. 204, pl. ix., figs. 4–6.

A single valve was collected on the Funafuti beach, which I refer with doubt to this species. It is more oblong than the figure quoted, but as I have no authentic specimen for comparison, and as Dall credits this species with great variation* in form and sculpture, I refrain from assigning specific value to the apparent difference. According to this writer, *P. australis*, Smith,† from Cape York, Queensland, is but a variety. The difference between this and such a figure as that of Sars‡ is great enough to include the form before me.

BRACHIOPODA.

THECIDEA MAXILLA, sp. nov.

(Fig. 57).

Shell small, of variable contour, somewhat boat shaped, attached to stones, shells, or the like, by the beak of the pedicle valve. Colour, dull pale yellow. Sculpture—both valves marked by delicate concentric growth lines and microscopically shagreened. Length of a large specimen, 6 mm.; breadth $3\frac{1}{2}$ mm.

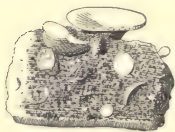


Fig. 57.

Pedicle valve deep, hinge line straight, cardinal area triangular, apex rather recurved. Margin finely granulate, frequently emarginate in front. Protruding from beneath the hinge are two slender prongs arising from a deep seated septum. External to these, and just beneath the hinge line, are two heavy, projecting, wedge-shaped cardinal teeth. The interior of the valve is irregularly studded with sharp points and

tubercles arranged longitudinally, and varying in different individuals.

* Dall—Bull. Mus. Comp Zool., xii., 1886, p. 282.

† Smith—Chall. Rep., Zool., xiii., 1885, p. 54, pl. xi., figs. 2, 2a, 2b.

‡ Sars—Mollusca regionis Arcticæ Norvegiæ, 1878, pl. v., figs. 6a, 6b.

The brachial valve is externally horse-shoe shaped, and has a slight median boss. Internally it has a straight hinge line, from beneath which and in the plane of the valve, projects a stout cardinal process, whose transverse vertical section would form an omega, hollow downwards. On either side of the cardinal process, and corresponding to the teeth of the lower valve, are two deep triangular impressions, the sockets. All the free edge of the upper valve is granulated. The frontal emargination gradually passes into a funnel directed backwards; here originates the median septum which tapers distally to an acicular point before the hinge. The ventral face of the septum is hollow, on the right and left of it are produced curled flanges with serrate edges. These edges vary much; in some, presumably old, individuals they project irregular jagged lobes into the cavity.

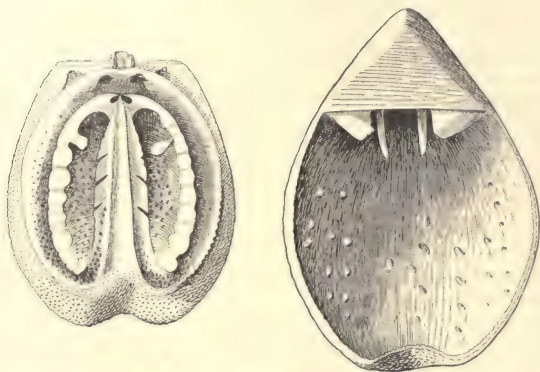


Fig. 57.

If this median septum be compared to the tongue, then the teeth of the human jaw would answer in position to the lateral lobes of the brachial lamellæ. Their development varies much; what I take to be a young stage is shown in my drawing. In other, presumably aged examples, the "canines" and "molars" project as tusks sideways and downwards, while the "incisors" coalesce and advance towards the hinge. The cavity of the valve, exclusive of the septum and lamellæ, has the surface densely perforated.

This species was attached in considerable numbers, horizontally, perpendicularly, or obliquely (Fig. 57) to loose sheets of dead coral which I pulled up by tangles in forty to eighty fathoms on the western slope of Funafuti. At first inspection I mistook them

for the young of a *Spondylus*, hence the erroneous statement on p. 402, that the Brachiopoda were absent from the Archipelago.

The genus *Thecidea* dates back from the opening of the Mesozoic, and is manifested in numerous species through a long range of formations. Like *Nautilus* and *Trigonia*, it now only survives in a few rare and restricted species. It is an interesting coincidence that a genus so intimately associated with fossil coral reefs in Europe, should recur alive on a Pacific Atoll. So far but two recent species, *T. mediterranea*, Risso, and *T. barretti*, Woodward, have been detected. The former, for which the subgenus *Lacazella* has been proposed by Munier Chalmas, is unlike the Pacific species; whereas the latter and the West Indian *T. barretti* are quite close. These conform neither to *Thecidea*, as restricted by Hall and Clarke,* nor to the various subgenera admitted by them. That generic term has been here used in the wider application of Davidson.

On comparing examples of *T. maxilla* with the published accounts of *T. barretti*, I conclude that the characters are so variable that a large series of each will be necessary to discriminate properly between them. At present I would point to the flanges of the median septum and to the greater development of the brachial lamellæ, as features possessed by *T. maxilla* but not by *T. barretti*.† The former, indeed, reminds one of a split walnut.

I am in doubt whether a pseudo-deltidium exists in *T. barretti*, for Davidson writes‡ that "in external shape it cannot be distinguished from the Mediterranean species," which has the pseudo-deltidium; and in a small drawing§ he indicates the pseudo-deltidium. But, on the other hand, in the enlarged drawing,|| on which I place more reliance, it is not depicted. Again, it is not shown in his first illustration,¶ nor is it mentioned in either description. Should a pseudo-deltidium be absent in *T. barretti*, as it certainly is in *T. maxilla*, that would isolate these two from the remainder of the genus.

Another feature in common is the fork which projects in two slender prongs between the cardinal teeth in both species, and strikingly differs from the spoon-shaped processes of *T. mediterranea* and from the three prongs of *T. radiata*, the type of the genus.

* Hall and Clarke—47th Ann. Report New York State Mus., 1894, pp. 1091–1093.

† Dall—Bull. Mus. Comp. Zool., xii., 1886, pl. vi., fig. 2.

‡ Davidson—Trans. Linn. Soc., Zool. (2), iv., 1889, p. 162.

§ Davidson—*Loc. cit.*, pl. xxiii., fig. 9a.

|| Davidson—*Loc. cit.*, pl. xxiii., fig. 10.

¶ Davidson—Geol. Mag., i., 1864, pl. ii., fig. 1a.

SUMMARY OF THE FAUNA OF FUNAFUTI.

XIX.

SUMMARY OF THE FAUNA OF FUNAFUTI.

THE fauna of the Atoll of Funafuti, as presented by different writers in the preceding pages, will now be briefly enumerated in systematic order. With that information will also be incorporated various records, either overlooked in the preparation of the articles referred to, or produced since their publication, and embracing the Archipelago as a whole.

Prior to the advent of the Expedition, not more than eight species of animals were recorded in literature from Funafuti; the following lists embrace about eight hundred and fifty entries.

Though the student of Zoogeography will herein find a more complete account of the life of a Central Pacific Atoll than has previously appeared, he is cautioned not to use it as an exhaustive catalogue. The results of brief sojourn by a few poorly equipped visitors, may indeed present a picture in which the salient features loom obscurely, as in a partly-developed photograph, but nothing more.

Class MAMMALIA.

Mus exulans, *Peale*.

Delphinus, *sp.*

Class AVES.

The account of the Avifauna of the atoll by Mr. A. J. North (pp. 79–88) can be supplemented by a few additions. Dr. H. Gadow has briefly enumerated the birds shot on Funafuti by Mr. J. S. Gardiner.* To these he adds *Carpophaga pistrinaria*, a species identified on the wing by his informant. As Mr. Gardiner was not previously acquainted with this species, such an identification cannot be considered of value, and I accordingly exclude it. In 1897 Mr. W. G. Woolnough, B.Sc., succeeded in shooting an example of the much debated Ellice Island Pigeon, which was subsequently determined by Mr. A. J. North as *Globicera pacifica*.†

The avifauna of the Archipelago will doubtless be found on examination to contain most, if not all, of the twenty-six birds observed in the neighbouring Phoenix Group.‡ At present the revised list drawn up by Mr. A. J. North, consists of the following fifteen species:—

* Gadow—Ibis (7), iv., Jan. 1898, p. 45.

† North—Rec. Aust. Mus., iii., June, 1898, p. 86.

‡ Lister—Proc. Zool. Soc., 1891, p. 300.

Urodynamis taitensis, *Sparrmann*.
Fregata aquila, *Linne*.
Demiegretta sacra, *Gmelin*.
Globicera pacifica, *Gmelin*.
Charadrius fulvus, *Gmelin*.
Totanus incanus, *Gmelin*.
Numenius taheiteneis, *Gmelin*.
Streptilas interpres, *Linne*.
Limosa novæzealandiæ, *Gray*.
Anous stolidus, *Linne*.
Micranous leucocapillus, *Gould*.
Procelsterna caerulea, *Bennett*.
Sterna anaesthesia, *Scopulinus*.
 ,, *melanauchen*, *Temminck*.
Gygis candida, *Gmelin*.

Class REPTILIA.

Chelone mydas, *Linne*.
Gymnodactylus pelagicus, *Girard*.
Gehyra oceanica, *Lesson*.
Lygosoma cyanurum, *Lesson*.
 ,, *adpersum*, *Steindachner*.

Class PISCES.

The following list includes the fishes of Funafuti as reported by Mr. E. R. Waite (*ante* pp. 181–201, and Supplement, *vide* Appendix). About a fifth of them appears in a list of fishes obtained at Rotuma by Mr. J. S. Gardiner.*

Epinephelus urodelus, *Cuvier and Valenciennes*.
 ,, *leopardus*, *Lacépède*.
 ,, *tauvina*, *Forskål*.
 ,, *merra*, *Bloch*.
 ,, *fuscoguttatus*, *Forskål*.
Grammistes sexlineatus, *Thunberg*.
Lutianus bengalensis, *Bloch*.
 ,, *gibbus*, *Forskål*.
 ,, *fulviflamma*, *Forskål*.
Zanclus cornutus, *Linne*.
Chætodon auriga, *Forskål*.
Mulloides flavolineatus, *Lacépède*.
 ,, *samoensis*, *Günther*.
Upeneus trifasciatus, *Lacépède*.
Lethrinus rostratus, *Cuvier and Valenciennes*.
 ,, *ramak*, *Forskål*.
Sphærodon grandoculis, *Forskål*.
Cirrhitès maculatus, *Lacépède*.

* Boulenger—Ann. Mag. Nat. Hist. (6), xx., 1897, pp. 371–4.

- Holocentrum erythræum*, *Günther*.
 „ *diploxiphus*, *Günther*.
Teuthis rostrata, *Cuvier and Valenciennes*.
Histiophorus *sp.*
Acanthurus triostegus, *Linne*.
 „ *guttatus*, *Forsk.*
 „ *blochii*, *Cuvier and Valenciennes*.
 „ *achilles*, *Shaw*.
Naseus lituratus, *Forsk.*
Caranx sanctæ helenæ, *Cuvier and Valenciennes*.
 „ *crumenophthalmus*, *Bloch*.
Chorinemus sancti-petri, *Cuvier and Valenciennes*.
Trachynotus baillonii, *Lacépède*.
Thynnus pelamys, *Linne*.
Ruvettus pretiosus, *Cocco*.
Echeneis naucrates, *Linne*.
Gobius biocellatus, *Cuvier and Valenciennes*.
Salarias marmoratus, *Bennett*.
 „ *periophthalmus*, *Cuvier and Valenciennes*.
 „ *quadricornis*, *Cuvier and Valenciennes*.
Sphyræna *sp.*
Myxus leuciscus, *Günther*.
Tetradrachmum aruanum, *Bloch*.
Glyphidodon brownriggii, *Bennett*.
 „ *sordidus*, *Forsk.*
 „ *septum-fasciatus*, *Cuvier and Valenciennes*.
Chilinus trilobatus, *Lacépède*.
 „ *fasciatus*, *Bloch*.
Epibulus insidiator, *Pallas*.
Julis lunaris, *Linne*.
Pseudoscarus pulchellus, *Rüppell*.
 „ *bataviensis*, *Bleeker*.
 „ *singaporensis*, *Bleeker*.
 „ *troschelli*, *Bleeker*.
Fierasfer homii, *Richardson*.
Platophrys pantherinus, *Rüppell*.
Belone platyura, *Bennett*.
Hemirhamphus balinensis, *Bleeker*.
Exocætus *sp.*
Ophichthys colubrinus, *Boddaert*.
Muræna formosa, *Bleeker*.
 „ *buroënsis*, *Bleeker*.
Balistes fuscus, *Bloch*.
 „ *flavomarginatus*, *Rüppell*.
 „ *aculeatus*, *Linne*.
Tetrodon nigropunctatus, *Bloch*.
 „ *margaritatus*, *Rüppell*.
 „ *immaculatus*, *Bloch*.
Dicotylichthys punctulatus, *Kaup*.

Carcharias lamia, *Risso*.
Galeocerdo rayneri, *M'Donald and Barron*.
Alopias vulpes, *Gmelin*.
Urogymnus asperimus, *Bloch*.
Trygon sp.
Ceratoptera sp.

Class HEMICHORDA.

Ptychodera flava, *Eschscholtz*.
 „ *hedleyi*, *Hill*.

Class CRUSTACEA.

Since the issue of the foregoing part of this Memoir dealing with the Crustacea, there has appeared a valuable series of articles by Mr. L. A. Borradaile* on Crustacea from the South Pacific, including those taken on Funafuti by Mr. J. S. Gardiner.

Mr. Borradaile conjectures that as *Pagurus setifer* is so closely allied to *P. guttatus*, the record of the latter from Funafuti may be a case of mistaken identity. Mr. Whitelegge, on re-examination of the example in question, maintains that it cannot be *P. setifer*, inasmuch as, among other characters, the left leg of the third pair in the Funafuti crab is setiferous all round and without sculpture; whereas both the description of Milne Edwards and the figure of Hilgendorf, confine the bristles to the margin of the leg of *P. setifer*. The identification was arrived at after comparison with examples of *P. setifer* from Mauritius and Fiji.

A *Lambrus* allied to *L. intermedius*, Miers, and possibly new, was dredged by Mr. G. Halligan at a depth of two hundred fathoms off Tutaga Islet, Funafuti.

A Cirriped, noted by Schmeltz from the Ellice,† *Lithothyra rhodiopus*, has also been included.

Lambrus sp.
Atergatis floridus, *Rumphius*.
Actæa rugata, *Adams and White*.
Xanthodes lamarekii, *Milne Edwards*.
 „ *nitidulus*, *Dana*.
Zozymus æneus, *Dana*.
Daira perlata, *Herbst*.
Etisus laevimanus, *Randall*.
Etisodes caelatus, *Dana*.
Carpilodes margaritatus, *Milne Edwards*.
Pilumnus vestitus, *Haswell*.
 „ *prunosus*, *Whitelegge*.

* Borradaile—Proc. Zool. Soc., 1898, pp 32-38, 457-468, 1000-1015; and Ann. Mag. Nat. Hist. (7), ii., 1898, pp. 376-391.

† Schmeltz—Cat. Mus. Godeff., v., 1874, p. 83.

- Actaeodes speciosa*, Dana.
Phymodius monticulosus, Dana.
Pseudozius caystrus, Adams and White.
Leptodius exaratus, Milne Edwards.
 " *sanguineus*, Milne Edwards.
Ruppellia annulipes, Milne Edwards.
Eriphia scabricula, Dana.
 " *laevimana*, Latreille.
Trapezia cymodoce, Herbst.
 " *ferruginea*, Latreille.
Thalamita integra, Dana.
 " *admete*, Herbst.
Cardisoma hirtipes, Dana.
Ocypoda ceratophthalma, Pallas.
Gelasimus tetragonon, Herbst.
Metopograpsus messor, Forskal.
Grapsus maculatus, Catesby.
Geograpsus crinipes, Dana.
Leiolophus planissimus, Herbst.
Calappa hepatica, Linne.
Cryptodromia japonica, Henderson.
Remipes pacificus, Dana.
Birgus latro, Linne.
Cenobita olivieri, Owen.
 " *clypeata*, Milne Edwards.
 " *perlata*, Milne Edwards.
 " *rugosa*, Milne Edwards.
 " " *var. pulchra*, Dana.
Diogenes pallescens, Whitelegge.
Pagurus fabimanus, Dana.
 " *setifer*, Milne Edwards.
 " *guttatus*, Olivier.
 " *euopsis*, Dana.
Clibanarius virescens, Dana.
 " *corallinus*, Milne Edwards.
Clibanarius æquabilis, Dana.
 " *zebra*, Dana.
 " *cruentatus*, Milne Edwards.
Calcinus elegans, Milne Edwards.
 " *gaimardi*, Milne Edwards.
 " *latens*, Randall.
 " *herbsti*, de Man.
 " " *var. lividus*, Milne Edwards.
Aniculus typicus, Fabricius.
Galathea affinis, Ortmann.
Petrolisthes lamarekii, Leach.
 " " *var. asiaticus*, Leach.
 " " *var. rufescens*, Heller.
 " " *var. fimbriatus*, Borradaile.

- Porcellana sollasi*, *Whitelegge*.
Ibacus antarcticus, *Rumphius*.
Palinurus guttatus, *Latreille*.
Palæmonella tridentata, *Borradaile*.
Hippolyte gibberosus, *Milne Edwards*.
Saron marmoratus, *Olivier*.
Athanas sulcatipes, *Borradaile*.
Alphæus edwardsii, *Audouin*.
 ,, *laevis*, *Randall*.
 ,, *strenuus*, *Dana*.
 ,, *parvirostris*, *Dana*.
 ,, *collumianus*, *Stimpson*.
 ,, *frontalis*, *Say*.
 ,, *prolificus*, *Bate*.
 ,, *funafutensis*, *Borradaile*.
Betaeus minutus, *Whitelegge*.
Periclimenes danae, *Stimpson*.
Coralliocaris brevirostris, *Borradaile*.
Anchistus miersi, *de Man*.
Callianidea typa, *Milne Edwards*.
Gondactylus chiragra, *Fabricius*.
Pseudosquilla ciliata, *Fabricius*.
Cirolana latystylis, *Dana*.
Athelgue aniculi, *Whitelegge*.
Lithotrya nicobarica, *Reinhardt*.
 ,, *rhodiopus*, *Gray*.

Class ARACHNIDA.

Since the publication of the preceding account (pp. 89 – 124) of the Spiders and Insects of Funafuti, Mr. R. I. Pocock has dealt with the series simultaneously collected by Messrs. Sollas and Gardiner, which embraced forms not procured by Mr. Hedley.* Mr. Pocock differs from Mr. Rainbow in sundry matters of species and genera. In the determination of the Scorpion, the latter accepts his correction, but he maintains the specific status of the various Spiders disputed by Mr. R. I. Pocock. Though the two names, *Obisium antipodum*, Simon, and *Olpium longiventer*, Keyserling, probably refer to one species, both provisionally appear in the following list. This under Mr. Rainbow's guidance, has been compiled from the two articles mentioned. It therefore represents his latest opinion on the subject. Included are also the Lepidoptera previously recorded from the Archipelago by Butler; two beetles, *Ceresium simplex* and *Sphenophorus obscurus*, taken by Mr. A. E. Finckh on Funafuti, in 1898; and a series of ants, noted from the Ellice by Mayr.† One of the new beetles discovered at

* R. I. Pocock—Ann. Mag. Nat. Hist. (7), i., 1898, pp. 321 – 326.

† Mayr—Journ. Mus. Godeff., xii., 1876, p. 56 – 115.

Funafuti, has lately been re-taken at Fife Bay, British New Guinea.* The *Ceresium* occurs at Norfolk Island.

- Hormurus australasiæ*, *Fabricius*.
Garypus longidigitatus, *Rainbow*.
Obisium antipodum, *Simon*.
Olpium longiventer, *Keyserling*.
Araneus theis, *var. mangareva*, *Walckenaer*.
 „ *plebeja*, *L. Koch*.
 „ *ventricosa*, *Rainbow*.
 „ *longispina*, *Rainbow*.
 „ *etheridgei*, *Rainbow*.
 „ *festiva*, *Rainbow*.
 „ *obscura*, *Rainbow*.
 „ *annulipes*, *Rainbow*.
 „ *distincta*, *Rainbow*.
 „ *hoggi*, *Rainbow*.
 „ *speciosa*, *Rainbow*.

Tetragnatha laqueata, *L. Koch*.
 „ *panopea*, *L. Koch*.

Uloborus geniculatus, *Olivieri*.

Dictis striatipes, *L. Koch*.

Clubiona alveolata, *L. Koch*.

Heteropoda venatoria, *Linne*.

Sarotes debilis, *L. Koch*.

Acompse suavis, *L. Koch*.

Ascyltus pterygodes, *L. Koch*.

Hyllus ferox, *Rainbow*.

„ *audax*, *Rainbow*.

Oribata lamellata, *Rainbow*.

Class MYRIOPODA.

Scolopendra morsicans, *Linne*.

Otostigmus astenon, *Kohlrausch*.

Mecistocephalus punctifrons, *Newport*.

Orphmaeus phosphoreus, *Linne*.

Trichocambala sollasi, *Pocock*.

Class INSECTA.

Monocrepidius ferrugineus, *Montrouzier*.

„ *umbraculatus*, *Candèze*.

Uloma cavicollis, *Fairm*.

„ *insularis*, *Guérin*.

Sphenophorus sulcipes, *Karsch*.

„ *obscurus*, *Boisduval*.

Elytrurus squamatus, *Rainbow*.

Nacerdes transmarina, *Rainbow*.

* Rainbow—Proc. Linn. Soc. N.S.W., xxiii., 1898, p. 365.

- Ceresium simplex*, *Gyllenhal*.
Concephalus ensiger, *Harold*.
Panesthia aethops, *Stoll*.
Loboptera decipiens, *Germain*.
Arachnocephalus vestitus, *Costa*.
Calotermes marginipennis, *Latreille*.
Megachile hedleyi, *Rainbow*.
Camponotus novæhollandiæ, *Mayr*.
Prenolepis vividula, *Nylander*.
Plagiolepis gracilis, *Smith*.
Meranoplus oceanicus, *Smith*.
 ,, *pubescens*, *Smith*.
Pheidole sexspinosæ, *Mayr*.
 ,, *oceanica*, *Mayr*.
Euphloea eleutho, *Quoy and Gaimard*.
 ,, *distincta*, *Butler*.
Junonia vellida, *Fabricius*.
Diademæ nerina, *Fabricius*.
 ,, *otaheitæ*, *Felder*.
Deiopea pulchella, *Linne*.
Achæa melicerte, *Drury*.
Remigia translata, *Walker*.
Chloanges suralis, *Zeller*.
Amyna octo, *Guénée*.
Erilita modestalis, *Lederer*.
Rinecera mirabilis, *Butler*.
Harpagoneura complexa, *Butler*.
Halobates *sp.*
Culex hispidosus, *Skuse*.
Megarrhina inornata, *Walker*.
Lispe vittata, *Rainbow*.
Degeeria dawsoni, *Rainbow*.
Ebenia nigricruris *Rainbow*.
 ,, *fieldi*, *Rainbow*.

Class MOLLUSCA.

- Loligo brevipinnis*, *Pfeffer*.
Octopus tonganus, *Hoyle*.
Scissurella æquatoria, *Hedley*.
Schisomope plicata, *Hedley*.
Haliotis stomatiæformis, *Reeve*.
 ,, *ovina*, *Chemnitz*.
Emarginula clathrata, *Pease*.
 ,, *mariei*, *Crosse*.
Acmaea saccharina, *Linne*.
Phenacolepas senta, *Hedley*.
Trochus obeliscus, *Gmelin*.
 ,, *tubiferus*, *Kiener*.
 ,, *atropurpureus*, *Gould*.

- Trochus fastigatus*, *A. Adams*.
Gibbula concinna, *Dunker*.
 „ *phasianella*, *Deshayes*.
Monilea lifuana, *Fischer*.
 „ *tragema*, *Melvill and Standen*.
Euchelus instrictus, *Gould*.
Teinostoma qualum, *Hedley*.
 „ *parvulum*, *Hedley*.
 „ *rotatum*, *Hedley*.
 „ *tricarinatum*, *Melvill and Standen*.
Cirsonella ovata, *Hedley*.
Liotia crenata, *Kiener*.
 „ *sp.*
 „ *sp.*
 „ *parvissima*, *Hedley*.
Mecoliotia halligani, *Hedley*.
Phasianella wisemanni, *Baird*.
 „ *minima*, *Melvill*.
Stomatella sanguinea, *A. Adams*.
Stomatia phymotis, *Helbling*.
Gena rosacea, *Pease*.
Turbo petholatus, *var. caledonicus*, *Fischer*.
 „ *setosus*, *Gmelin*.
 „ *argyrostomus*, *Linne*.
Astridium petrosum, *Murty*.
Leptothyra laeta, *Montrouzier*.
Delphinula lacinata, *Lamarck*.
Neritopsis radula, *Linne*.
Nerita albicilla, *Linne*.
 „ *maxima*, *Chemnitz*.
 „ *plicata*, *Linne*.
 „ *polita*, *Linne*.
 „ *insculpta*, *Recluz*.
Neritina reticulata, *Sowerby*.
Helicina musiva, *var. rotundata*, *Mousson*.
Eulima pyramidalis, *A. Adams*.
 „ *samoensis*, *Crosse*.
 „ *diaphana*, *Hedley*.
 „ *decipiens*, *Hedley*.
Stylifer varicifer, *Hedley*.
Odontostomia bulinoides, *Souvertie*.
 „ *rubra*, *Pease*.
 „ *robusta*, *Hedley*.
 „ *biplicata*, *Hedley*.
Pyramidella dolabrata, *var. terebelloides*, *A. Adams*.
 „ *turrita*, *A. Adams*.
 „ *mitralis*, *A. Adams*.

Obtortio pyrrhacme, *Melvill and Standen*.

Scala revoluta, *Hedley*.

„ *paumotensis*, *Pease*.

„ *subauriculata*, *Souverbie*.

„ *ovalis*, *Sowerby*.

Scaliola lapillifera, *Hedley*.

Ianthina *sp.*

Natica violacea, *Sowerby*.

„ *marochiensis*, *Gmelin*.

„ *mamilla*, *Linne*.

„ *melanostoma*, *Gmelin*.

„ *umbilicata*, *Quoy and Gaimard*.

Vanikoró gueriniana, *Recluz*.

Capulus intortus, *Lamarck*.

„ *violaceus*, *Angas*.

Hipponyx australis, *Quoy*.

Mitrularia equestris, *var. tortilis*, *Reeve*.

Truncatella valida, *Pfeiffer*.

Omphalotropis zebriolata, *Mousson*.

Assiminea nitida, *Pease*.

Rissoa invisibilis, *Hedley*.

„ *finckhi*, *Hedley*.

„ *poolei*, *Hedley*.

Rissoina exasperata, *Souverbie*.

„ *gemmea*, *Hedley*.

„ *polytropa*, *Hedley*.

„ *plicata*, *Adams*.

„ *ambigua*, *Gould*.

„ *affinis*, *Garrett*.

Diala virgata, *Hedley*.

„ *hardyi*, *Melvill and Standen*.

„ *profunda*, *Hedley*.

Solarium hybridum, *Linne*.

Heliacus discoideus, *Pease*.

Littorina obesa, *Sowerby*.

Modulus tectum, *Gmelin*.

Risella conoidalis, *Pease*.

Plesiotrochus souverbianus, *Fischer*.

Fossarus lamellosus, *Montrouzier*.

Planaxis sulcatus, *Born*.

„ *lineatus*, *Da Costa*.

Melania mageni, *Gassies*.

Caecum vertebrale, *Hedley*.

„ *exile*, *De Folin*.

„ *gulosum*, *Hedley*.

„ *amaltheanum*, *Hedley*.

„ *legumen*, *Hedley*.

- Vermetus maximus, *Sowerby*.
 „ *sp.*
 Turritella concava, *Martens*.
 Strombus lentiginosus, *Linne*.
 „ floridus, *Lamarck*.
 „ dentatus, *var. rugosus*, *Sowerby*.
 „ hæmastoma, *Sowerby*.
 „ terebellatus, *Sowerby*.
 „ gibberulus, *Linne*.
 „ samar, *Dillwyn*.
 „ luhuanus, *Linne*.
 Pterocera aurantia, *Lamarck*.
 „ byronia, *Gmelin*.
 „ rugosa, *Sowerby*.
 Terebellum subulatum, *Lamarck*.
 Cerithium nodulosum, *Bruguère*.
 „ columna, *Sowerby*.
 „ citrinum, *Sowerby*.
 „ echinatum, *Lamarck*.
 „ maculosum, *Mighels*.
 „ rostratum, *Sowerby*.
 „ oceanicum, *Hedley*.
 „ breve, *var. ellicense*, *Hedley*.
 „ spiculum, *Hedley*.
 „ strictum, *Hedley*.
 „ variegatum, *Quoy and Gaimard*.
 „ zebrium, *Kiener*.
 „ impendens, *Hedley*.
 „ piperitum, *Sowerby*.
 „ obeliscus, *Bruguère*.
 „ „ *var. cedo-nulli*, *Sowerby*.
 „ asperum, *Linne*.
 „ pharos, *Hinds*.
 „ elegantissimum, *Hedley*.
 Contumax decollatus, *Hedley*.
 Cerithiopsis eutrapela, *Melvill and Standen*.
 „ electrina, *Hedley*.
 Triforis dolicha, *Watson*.
 „ aegle, *Jousseaume*.
 „ torquatus, *Hedley*.
 „ ruber, *Hinds*.
 „ clio, *Hedley*.
 „ obesula, *Jousseaume*.
 „ thetis, *Hedley*.
 „ incisus, *Pease*.
 „ corrugatus, *Hinds*.
 „ asperimus, *Hinds*.
 „ *spp.*

- Ovula hervieri*, *Hedley*.
Cypræa argus, *Linne*.
 „ *scurra*, *Chemnitz*.
 „ *testudinaria*, *Linne*.
 „ *isabella*, *Linne*.
 „ *carneola*, *Linne*.
 „ „ *var. propinqua*, *Garrett*.
 „ *talpa*, *Linne*.
 „ *goodalli*, *Gray*.
 „ *fimbriata*, *Gmelin*.
 „ *macula*, *Adams*.
 „ *mauritiana*, *Linne*.
 „ *caput-serpentis*, *Linne*.
 „ *mappa*, *Linne*.
 „ *arabica*, *Linne*.
 „ *reticulata*, *Martyn*.
 „ *moneta*, *Linne*.
 „ „ *var. annulus*, *Linne*.
 „ *tigris*, *Linne*.
 „ *vitellus*, *Linne*.
 „ *lynx*, *Linne*.
 „ *clandestina*, *var. artuffeli*, *Jousseau*.
 „ *cribraria*, *Linne*.
 „ *becki*, *Gaskoin*.
 „ *erosa*, *Linne*.
 „ *poraria*, *Linne*.
 „ *helvola*, *Linne*.
 „ *cicercula*, *Linne*.
 „ *nucleus*, *Linne*.
 „ *childreni*, *Gray*.
Trivia oryza, *Lamarck*.
Dolium perdix, *Linne*.
 „ *pomum*, *Linne*.
Cassis cornuta, *Linne*.
 „ *vibex*, *var. erinacea*, *Linne*.
Tritonium tritonis, *Linne*.
 „ *pileare*, *Linne*.
 „ *chlorostomum*, *Lamarck*.
 „ *gemmatum*, *Reeve*.
 „ *digitale*, *Reeve*.
 „ *tuberosum*, *Lamarck*.
 „ *maculosum*, *Gmelin*.
Distortrix anus, *Linne*.
Gyrineum bufonium, *Gmelin*.
 „ *affine*, *Broderip*.
Peristernia nassatula, *Lamarck*.
Latirus polygonus, *var. barclayi*, *Reeve*.
 „ *craticulatus*, *Linne*.

- Pisania fasciculata*, *Reeve*.
Cantharus undosus, *Linne*.
Murex ramosus, *Linne*.
 ,, *adustus*, *Lamarck*.
 ,, *funafutiensis*, *Hedley*.
 ,, *radula*, *Hedley*.
Purpura hippocastaneum, *Lamarck*.
 ,, *armigera*, *Chemnitz*.
Jopas sertum, *Bruguère*.
Sistrum hystrix, *Linne*.
 ,, *horridum*, *Lamarck*.
 ,, *ricinus*, *Linne*.
 ,, *morus*, *Lamarck*.
 ,, *digitatum*, *Lamarck*.
 ,, *tuberculatum*, *Blainville*.
 ,, *cancellatum*, *Quoy*.
 ,, *fiscellum*, *Chemnitz*.
Coralliophila coronata, *Barclay*.
Galeropsis madreporarum, *Sowerby*.
Magilus antiquus, *Lamarck*.
Nassa semitexta, *Hedley*.
 ,, *granifera*, *Kiener*.
Columbella varians, *Sowerby*.
 ,, *galaxias*, *Reeve*.
 ,, *melvilli*, *Hedley*.
 ,, *alofa*, *Hedley*.
 ,, *obtusata*, *Sowerby*.
 ,, *tringa*, *Lamarck*.
 ,, *rubicunda*, *Quoy and Gaimard*.
Engina parva, *Pease*.
 ,, *nodicostata*, *Pease*.
 ,, *mendicaria*, *Linne*.
Mitra episcopalis, *Linne*.
 ,, *pontificalis*, *Lamarck*.
 ,, *flammea* var. *hystrix*, *Montrouzier*.
 ,, *cucumerina*, *Lamarck*.
 ,, *chrysalis*, *Reeve*.
 ,, *tabanula* var. *caledonica*, *Recluz*.
 ,, *ferruginea*, *Lamarck*.
 ,, *acuminata*, *Swainson*.
 ,, *brunnea*, *Pease*.
 ,, *astricta*, *Reeve*.
 ,, *limbifera*, *Lamarck*.
 ,, *litterata*, *Lamarck*.
 ,, *paupercula*, *Linne*.
 ,, *virgata*, *Reeve*.
Turricula gruneri, *Reeve*.
 ,, *exasperata*, *Chemnitz*.

- Turricula angulosa*, *Kuster*.
 „ *variata*, *Reeve*.
 „ *nodosa*, *Swainson*.
 „ *pilsbryi*, *Hedley*.
Cylindra dactylus, *Linne*.
Erato schmeltziana, *Crosse*.
Marginella sandwicensis, *Pease*.
 „ *iota*, *Hedley*.
 „ *peasii*, *Reeve*.
 „ *isseli*, *var. ellicensis*, *Hedley*.
Olivella simplex, *Pease*.
Oliva guttata, *Lamarck*.
 „ *irisans*, *var. erythrostroma*, *Lamarck*.
Harpa minor, *Lamarck*.
 „ *gracilis*, *Broderip and Sowerby*.
Drillia unizonalis, *Lamarck*.
Glyphostoma purpurascens, *Dunker*.
 „ *aliceæ*, *Melville and Standen*.
 „ „ *var. tenera*, *Hedley*.
 „ *malleti*, *Recluz*.
Thetidos morsura, *Hedley*.
Mangilia himerta, *Melville and Standen*.
Clathurella lactea, *Reeve*.
 „ *clandestina*, *Deshayes*.
 „ *apicalis*, *Montrouzier*.
 „ *irretita*, *Hedley*.
Daphnella delicata, *Reeve*.
 „ *lymneiformis*, *Kiener*.
 „ *pupoidea*, *H. Adams*.
 „ *thiasotes*, *Melville and Standen*.
Conus literatus, *Linne*.
 „ *tessellatus*, *Born*.
 „ *pulicarius*, *Hwass*.
 „ *hebraeus*, *Linne*.
 „ „ *var. vermiculatus*, *Hwass*.
 „ *ceylonensis*, *Hwass*.
 „ *vexillum*, *Gmelin*.
 „ *rattus*, *Hwass*.
 „ *capitaneus*, *Linne*.
 „ *lividus*, *Hwass*.
 „ „ *var. flavidus*, *Lamarck*.
 „ *vitulinus*, *Hwass*.
 „ *catus*, *Hwass*.
 „ *nussatella*, *Linne*.
 „ *striatus*, *Linne*.
 „ *geographus*, *Linne*.
 „ *tulipa*, *Linne*.
 „ *auratus*, *Linne*.

- Terebra crenulata*, Linne.
 „ *dimidiata*, Linne.
 „ *maculata*, Linne.
 „ *subulata*, Linne.
 „ *tigrina*, Gmelin.
 „ *affinis*, Gray.
Pterosoma plana, Lesson.
Atlanta gibbosa, Eydoux and Souleyet.
 „ *turriculata*, D'Orbigny.
 „ *guidichaudi*, Eydoux and Souleyet.
Solidula sulcata, Gmelin.
Tornatina voluta, Quoy and Gaimard.
 „ *hadfieldi*, Melvill and Standen.
 „ *leptekes*, Watson.
Retusa waughiana, Hedley.
Atys cylindrica, Hebling.
 „ *hyalina*, Watson.
 „ *dentifera*, A. Adams.
 „ *dactylus*, Hedley.
Cylichna erecta, Hedley.
Haminea vitrea, A. Adams.
Cylindrobulla sculpta, Nevill.
Akera aperta, Hedley.
Hydatina amplustre, Linne.
 „ *physis*, Linne.
Ringicula parvula, Hedley.
 „ *incisa*, Hedley.
 „ *sp.*
Limacina inflata D'Orbigny.
 „ *bulimodes*, D'Orbigny.
Clio virgula, Rang.
 „ *acicula*, Rang.
 „ *striata*, Rang.
 „ *subula*, Quoy and Gaimard.
 „ *pyramidata*, Linne.
Cuvierina columella, Rang.
Cavolinia quadridentata, Lesueur.
 „ *longirostris*, Lesueur.
 „ *inflexa*, Lesueur.
Agadina stimpsoni, A. Adams.
Elysia nigropunctata, var. *sanguinea*, Hedley.
Phyllidia varicosa, Lamarck.
Plecotrema bellum, H. and A. Adams.
 „ *mordax*, Dohrn.
Melampus fasciatus, Deshayes.
 „ *luteus*, Quoy and Gaimard.
Tornatellina oblonga, Pease.
 „ *conica*, Mousson.

- Vertigo pediculus, *Shuttleworth*.
 Stenogyra gracilis, *Hutton*.
 Endodonta modicella, *Ferussac*.
 „ decemplicata, *Mousson*.
 Trochonanina samoensis, *Mousson*.
 Dentalium lessoni, *Deshayes*.
 Cadulus aratus, *Hedley*.
 Anomia *sp.*
 Arca zebra, *Swainson*.
 „ maculata, *Sowerby*.
 „ reticulata, *Gmelin*.
 „ velata, *Sowerby*.
 „ tenella, *Reeve*.
 „ congenita, *Smith*.
 „ pteroessa, *Smith*.
 Limopsis davidi, *Hedley*.
 Septifer excisus, *Wiegman*.
 Modiola australis, *Gray*.
 Lithophaga teres, *Philippi*.
 „ levigata, *Quoy and Gaimard*.
 Plicatula imbricata, *Menke*.
 Spondylus ocellatus, *Reeve*.
 Lima bullata, *Sowerby*.
 „ tenera, *Chemnitz*.
 „ squamosa, *Lamarck*.
 „ angulata, *Sowerby*.
 „ fragilis, *Gmelin*.
 Limea pectinata, *H. Adams*.
 Pecten squamatus, *Gmelin*.
 „ pallium, *Linne*.
 „ distans, *Reeve*.
 „ madreporarum, *Sowerby*.
 „ speciosus, *Reeve*.
 Hinnites *sp.*
 Pteria peasei, *Dunker*.
 „ cumingii, *Reeve*.
 Melina samoensis, *Baird*.
 Pinna *sp.*
 Ostrea hanleyana, *Sowerby*.
 „ cristagalli, *Linne*.
 Cardita sweeti, *Hedley*.
 Lucina exasperata, *Reeve*.
 „ punctata, *Linne*.
 „ divergens, *Philippi*.
 „ oblonga, *Hedley*.
 Corbis fimbriata, *Linne*.
 Cryptodon globosum, *Forskal*.
 Tellina rugosa, *Born*.

- Tellina scobinata*, *Linne*.
 „ *flammula*, *Deshayes*.
 „ *dispar*, *Conrad*.
 „ *obliquaria*, *Deshayes*.
 „ *rhomboides*, *Quoy and Gaimard*.
 „ *robusta*, *Hanley*.
 „ *opalina*, *Sowerby*.
 „ *fijiensis*, *Sowerby*.
 „ *crebrimaculata*, *Sowerby*.
 „ *ellicensis*, *Hedley*.
Libitina guineaica, *Lamarck*.
Circe pectinata, *Linne*.
 „ *picta*, *Lamarck*.
 „ *castrensis*, *Linne*.
Cytherea obliquata, *var. prora*, *Conrad*.
 „ *subpellucida*, *Sowerby*.
Venus toreuma, *Gould*.
 „ *puerpera*, *var. listeri*, *Gray*.
Venerupis macrophylla, *Deshayes*.
Narano lapicida, *Chemnitz*.
Crassatella *sp.*
Kellya pacifica, *Hedley*.
Scintilla semiclausula, *Sowerby*.
Atactodea striata, *Gmelin*.
Asaphis deflorata, *Linne*.
Psammobia squamosa, *Lamarck*.
Cardium angulatum, *Lamarck*.
 „ *maculosum*, *Wood*.
 „ *cardissa*, *var. dionæum*, *Sowerby*.
 „ *fragrum*, *Linne*.
 „ „ *var. sueziense*, *Issel*.
Tridacna gigas, *var. squamosa*, *Lamarck*.
 „ *elongata*, *Lamarck*.
Chama imbricata, *Broderip*.
 „ *spinosa*, *Broderip*.
 „ *unicornis*, *Bruguère*.
Corbula taheitensis, *Lamarck*.
Gastrochæna lamellosa, *Deshayes*.
Nausitoria aurita, *Hedley*.
Tonicia *sp.*

Class BRACHIOPODA.

Thecidea maxilla, *Hedley*.

Class ECHINODERMATA.

To the Echinodermata enumerated in the body of this work there are added in the following list the species collected by

J. S. Gardiner, and determined by F. P. Bedford and F. J. Bell.* A sea-urchin, believed to be *Metalia sternalis*, Gray, was occasionally found dead at high-water mark on the beaches of the leeward islets of Funafuti, but as no specimens were preserved for exact identification, it is not here included. A starfish dredged off the north-west corner of Funafuti, at a depth of one hundred and thirty fathoms by H.M.S. "Penguin," which was, in life, bordered by segments of brick-red and yellow-red, size R. 30 mm., has been presented to the Australian Museum by Lieutenant A. Waugh, R.N. This has been determined by Mr. Whitelegge as probably an immature example of *Nardoa gomophia*, Perrier, originally described from New Caledonia.†

- Echinothrix diadema*, Linne.
- „ *turcarum*, Schynvoet.
- Heterocentrotus mamillatus*, Klein.
- Echinometra lucunter*, Leske.
- „ *oblonga*, Blainville.
- Echinus angulosus*, Leske.
- Laganum depressum*, Lesson.
- Echinoneus cyclostomus*, Leske.
- Maretia planulata*, Lamarck.
- Ophidiaster cylindricus*, Lamarck.
- Linekia pacifica*, Gray.
- Nardoa gomophia*, Perrier.
- Culcita acutispina*, Bell.
- Ophiactis savignii*, Muller and Troschel.
- Ophiocoma scolopendrina*, Agassiz.
- „ *erinaceus*, Muller and Troschel.
- Ophiarthrum elegans*, Peters.
- Mulleria echinites*, Jaeger.
- „ *parvula*, Selenka.
- Holothuria argus*, Jaeger.
- „ *atra*, Jaeger.
- „ „ *var. amboinensis*, Semper.
- „ *vagabunda*, Selenka.
- „ *maculata*, Brandt.
- „ *imitans*, Ludwig.
- Chiridota intermedia*, Bedford.
- Synapta ooplax*, Marenzeller.

Class ANNELIDA.

- Eurythoe complanata*, Pallas.
- „ *pacifica*, *var. levukænsis*, McIntosh.
- Phyllodoce* *sp.*
- Perichæta grubei*, Rosa.
- „ *sp.*

* Bedford and Bell—Proc. Zool. Soc., 1898, pp. 834–850.

† Perrier—Archiv. Zool. Exper., iv., 1875, p. 431.

Class GEPHYREA.

To the list of Gephyrean worms recorded by A. E. Shipley from Funafuti,* has been added *A. steenstrupii*, identified (*ante* p. 394) by Mr. Whitelegge. The distribution of most of these has been further elucidated by Shipley in a Report on the Willey Collection.†

- Sipunculus vastatus, *Selenka and Bulow*.
- „ funafuti, *Shipley*.
- Physcosoma nigrescens, *Keferstein*.
- „ pacificum, *Keferstein*.
- „ scolops, *Selenka and de Man*.
- „ varians, *Keferstein*.
- „ microdontodon, *Sluiter*.
- „ dentigerum, *Selenka and de Man*.
- Aspidosiphon elegans, *Chamisso and Eysenhardt*.
- „ steenstrupii, *Diesing*.
- „ klunzingeri, *Selenka and Bulow*.
- Cloeosiphon aspergillum, *Quatrefages*.

Class PORIFERA.

- Reniera australis, *Lendenfeld*.
- „ *sp.*
- Halichondria solida *var. rugosa*, *Ridley and Dendy*.
- Spinosella glomerata, *Whitelegge*.
- Gellius aculeatus, *Whitelegge*.
- Clathria pellicula, *Whitelegge*.
- Agelas gracilis, *Whitelegge*.
- Echinodictyum asperum, *Ridley and Dendy*.
- Acanthella stipitata, *Carter*.
- „ pulcherrima, *Ridley and Dendy*.
- Ciocalyptra incrustans, *Whitelegge*.
- Polymastia dendyi, *Whitelegge*.
- Spirastrella papillosa, *Ridley and Dendy*.
- Euspongia irregularis *var. silicata*, *Lendenfeld*.
- Hippospongia dura, *Lendenfeld*.
- Spongelia fragilis *var. irregularis*, *Lendenfeld*.

Class HYDROZOA.

A dead specimen of *Distichopora rosea* was collected on the beach but was overlooked in packing. Some notes on *Millepora* from Funafuti have been published by Prof. S. J. Hickson.‡

- Thuiaria divergens, *Whitelegge*.
- Aglaophenia clavicula, *Whitelegge*.
- Millepora squarrosa, *Lamarck*.
- „ platyphylla, *Ehrenberg*.

* Shipley—Proc. Zool. Soc., 1898, pp. 468–473.

† Willey—Zoological Results, part 2, 1899, p. 151–158.

‡ Hickson—Proc. Zool. Soc., 1898, p. 828.

Millepora nodosa, *Esper*.

„ *tortuosa*, *Dana*.

Distichopora rosea, *Kent*.

Physalia megalista, *Lamarck*.

Class SCYPHOZOA.

Aurelia clausa, *Lesson*.

Polyrhiza orithyia, *Haeckel*.

Class ACTINOZOA.

The following list of Actinozoa is compiled from different sources under the supervision of Mr. Whitelegge, whose papers in this volume (pp. 213 - 225, 307 - 320, 349 - 368, and 384 - 391) have formed the basis. With these have been incorporated information from the articles of J. S. Gardiner and I. L. Hiles.*

In some prefatory notes to the Mollusca, it was remarked that the high proportion of novelties to the mass of previously known forms should not be mistaken for an indication of endemic importance, but should be ascribed to the imperfection of our knowledge of the continental faunas. This statement has received support from the Gorgonidæ in the brief time that has elapsed since it was written. *Keroioides gracilis* has been retaken by Willey in New Guinea, *Villogorgia rubra* by Willey in the Loyalty Islands, *Acamptogorgia spinosa* by Willey in New Britain, *Lobophytum hedleyi* and *L. densum* by Hedley in New Caledonia.

Some giant specimens of a white Sea Anemone, ten inches in diameter, were observed on Funafuti, but defied any effort to remove them and are hence unnoted in the following list.

The specific identification of Reef Corals is regarded by the highest authorities as a matter of extreme uncertainty. H. M. Bernard wrote :—"The only specimens which can be claimed with absolute certainty as specifically identical are a few which have in each case been gathered at the same place and time, and resemble one another as closely as if they were two fragments of one and the same stock. Beyond these no certainty exists, and strict regard to the variations of form and structure would compel us to label all the remaining specimens as different varieties or species."† To maintain such a position means chaos. Either we must, as Bernard proceeds to suggest, "break loose from the restraint of the Linnean species," or deal with the group on the broader lines on which Hickson has lately dealt with the *Heliopora* and *Millepora*.

* Gardiner—Proc. Zool. Soc., 1897, pp. 941 - 953; Idem 1898, pp. 257 - 276, 525 - 539, and 994 - 1000; Hiles, in Willey, Zoological Results, part 2, 1899, pp. 195 - 204.

† Bernard—Cat. Madreporarian Corals Brit. Mus., 1896, p. 20.

Finding ourselves unable to reconcile the species enumerated by Whitelegge and Gardiner the results arrived at by each are given in parallel columns.

Sarcophytum	glaucum, Quoy and Gaimard.	
„	trochoheliophorum var. amboinense, Marenzeller.	
„	latum, Dana.	
Lobophytum	pauciflorum var. validum, Marenzeller.	
„	hedleyi, Whitelegge.	
„	marenzelleri, Wright and Studer.	
„	tuberculosum, Quoy and Gaimard.	
„	confertum, Dana.	
„	densum, Whitelegge.	
„	viride, Quoy and Gaimard.	
Spongodes	pallida, Whitelegge	
„	curvicornis, Wright and Studer.	
Siphonogorgia	godeffroyi, Kolliker.	
„	pallida, Studer.	
„	kollikeri, Wright and Studer.	
„	macrospina, Whitelegge.	
Heliopora	cærulea, Pallas.	
Keroides	gracilis, Whitelegge.	
Acamptogorgia	spinosa, Hiles.	
Acanthogorgia	breviflora, Whitelegge.	
Acanthomuricea	simplex, Whitelegge.	
Villogorgia	flagellata, Whitelegge.	
„	intricata, Gray.	
„	ruber, Hiles.	
Bebryce	studerii, Whitelegge.	
Muricella	purpurea, Whitelegge.	
Plexaura	antipathes, Esper.	
Nicella	laxa, Whitelegge.	
Verrucella	flabellata, Whitelegge.	
Antipathella	brookii, Whitelegge.	
Zoanthus	funafutiensis, Hill and Whitelegge.	
Gemmaria	willei, Hill and Whitelegge.	
Palythoa	howesi, Haddon and Shackleton.	
„	kochii, Haddon and Shackleton.	
„	coesia, Dana.	

REEF CORALS

Reported from Funafuti by,—

	Whitelegge.	Gardiner.
Caryophylla	clavus	Rhizotrochus, sp.
	var. epitheata, Duncan.	
Stylophora	digitata, Pallas.	Stylophora digitata, Pallas.
		„ flabellata, Quelch.
		„ compressa, Gardiner.
		„ rugosa, Gardiner.

Whitelegge.

- Pocillopora grandis*, Dana.
 „ *caespitosa*, Dana.
 „ *verrucosa*, E. & Sol.

- Mussa costata*, Dana.
Coeloria esperi, Edw. and H.
Hydnophora microconia, Lam.
Astræa versipora, Dana.
 „ *danæ*, Edw. and H.
 „ *denticulata*, E. and Sol.
Acanthastræa patula, Dana.
 „ *echinata*, Dana.
Leptastræa solida, Edw. and H.
 „ *transversa*, Klunz.
Cyphastræa danæ, Edw. and H.
Pavonia repens, Bruggeman.
 „ *explanata*, Lamarck.
Psammocera contigua, Esp.
 „ *fossata*, Dana.

- Oxypora* sp.
Fungia tenuidens, Quelch.
 „ *discus*, Dana.

- Madreporaria fruticosa*, Brook.
 „ *syringodes*, Brook.
 „ *spicifera*, Dana.
 „ *botryodes*, Brook
var. funafutiensis,
Whitelegge.

Gardiner.

- Stylophora pistillata*, Esper.
 „ *palmata*, Blainville.
 „ *lobata*, Gardiner.
Pocillopora grandis, Dana.
 „ *glomerata*, Gardiner.
 „ *rugosa*, Gardiner.
 „ *mæandrina*, Dana.
 „ *squarrosa*, Dana.
 „ *aspera*, Verrill.
 „ „ *var. danæ*, V.
 „ „ *var. ligulata*,
 Dana.
 „ *favosa*, Ehrenberg.
 „ *clavaria*, Ehrenberg.
 „ *brevicornis*, Lam.
 „ *septata*, Gardiner.
 „ *suffruticosa*, Verrill.
 „ *paucistella*, Quelch.
Seriatopora conferta, Quelch.
 „ *spinosa*, Ed. & Haime.

- Pavonia repens*, Bruggeman.
Psammocera contigua, Esp.
 „ *haimeana*, Ed. & H.
 „ *superficialis*, Gard.
 „ *savigniensis*, Gard.

- Halomitra irregularis*, Gardiner.
Herpolitha crassa, Gardiner.
Madreporaria fruticosa, Brook.
 „ *crateriformis*,
 Gardiner.
 „ *secunda*, Dana.
 „ *scabrosa*, Quelch.
 „ *reticulata*, Brook.

<i>Whitelegge.</i>	<i>Gardiner.</i>
Madreporaria patula, Brook.	Madreporaria profunda, Gard.
„ efflorescens, Dana.	„ surculosa, Dana.
„ eurystoma, Klunz.	„ latistella, Brook.
„ spinulifera,	„ sinensis, Brook.
<i>Whitelegge.</i>	„ cuneata, Dana.
„ impressa, <i>Whitelegge.</i>	„ bæodactyla, Brook.
	„ loripes, Brook.
	„ angulata, Quelch.
Astræopora incrustans, Bernard.	Astræopora listeri, Bernard.
„ ocellata, Bernard.	„ tabulata, Gardiner.
„ hirsuta, Bernard	„ ovalis, Bernard.
Montipora verrucosa, Dana.	Montipora verrucosa, Lamarck.
„ foveolata, Dana.	„ profunda, Bernard.
„ tuberosa, Klunzinger.	„ caliculata, Dana, var.
„ scabricula, Dana.	„ piriformis, Bernard.
„ exserta, Quelch.	„ saxea, Bernard.
	„ incognita, Bernard.
	„ granifera, Bernard.
Porites lutea, Edw. and H.	Porites arenosa, Esper.
„ lichen, Dana.	„ „ var. lutea, E. & H.
„ lobata, Dana.	„ „ var. parvicellata,
„ crassa, Quelch.	<i>Gardiner.</i>
„ mirabilis, Quelch.	„ purpurea, Gardiner.
„ gaimardi, Edw. and H.	„ trimurata, Gardiner.
	„ umbellifera, Gardiner.
	„ superfusa, Gardiner.
	„ exilis, Gardiner.

Class FORAMINIFERA.

Pressure of Museum duties has unfortunately not allowed the preparation of a Report on the Foraminifera collected at Funafuti.

APPENDIX.

THE FISHES OF FUNAFUTI. (SUPPLEMENT.)

By EDGAR R. WAITE, F.L.S.,
Zoologist, Australian Museum.

APPENDIX.

THE FISHES OF FUNAFUTI.

(SUPPLEMENT.)

BY EDGAR R. WAITE, F.L.S., Zoologist.

WHEN Mr. H. E. Finckh was about to leave for Funafuti in order to study living corals, it was suggested that he should collect objects of marine life for the Museum. In order the better to know our requirements, he interviewed my colleagues and myself; among other matters I especially impressed upon Mr. Finckh the desirability of obtaining the "Palu" mentioned in my report on the Fishes (pp. 199 - 201) as frequenting deep water in the neighbourhood of the coral atolls.

It was with considerable satisfaction therefore that on the return of the expedition, we learned that a "Palu" had been obtained. By the kind offices of the Local Funafuti Committee of the Royal Society, the specimen passed into the possession of the Trustees and has been entrusted to me for determination; it proves to be of most exceptional interest.

Owing to the large size of the fish and the difficulty of preserving it, it was cut into three pieces; an unfortunate proceeding, but one which does not interfere with its recognition. It proves to be as follows:—

GEMPYLIDÆ.

RUVETTUS, *Cocco*,RUVETTUS PRETIOSUS, *Cocco*.

Ruvettus pretiosus, Cocco, Giorn. Sci. Sicil., xlii., 1829, p. 21;
Goode and Bean, Oceanic Ichth., U.S. Nat. Mus. Sp. Bull.
No. 2., 1895, p. 196, pl. lvii., fig. 210.

This is a North Atlantic form and the only member of the genus. On the eastern side of the Atlantic basin it ranges from the Canary Islands to Portugal and is found at several stations in the Mediterranean: on the American coast it is common off Cuba and two examples have been taken east of New York. It is therefore distributed in the North Atlantic in twenty-five degrees of latitude, roughly speaking from 20° to 45° N. Its extreme eastern station appears to be Spalatro in the Adriatic 16° E., and its western limit Cuba 85° W; thus it extends over one hundred degrees of longitude.

The specimen now obtained enables us to extend its distribution surprisingly. Not only is it recorded in the Pacific, and south of the Equator, but many definite localities are known widely apart, while inferentially its Pacific range is very extensive indeed.

Taking Mr. Louis Becke's account (p. 199) the Palu is first to be noted as frequenting the neighbourhood of the Line Islands (the Gilberts or Kingsmill Group) thence at the Ellice Group where he describes it as being hooked at Nanomanga. From the same group, namely at Funafuti, we receive the specimen obtained by Mr. Finckh. The next locality is Tokelau or the Union Group, and still proceeding in a south westerly direction we encounter Pukapuka (Danger Island), Manahiki (Humphrey Island), and Suwarrow, and further to the south Niue or Savage Island.

We have thus definite records of the occurrence of the Palu through twenty-six degrees of longitude, that is from the Gilberts 173° E. to Manahiki 161° W., and nineteen degrees of latitude, namely from the Equator (or thereabouts) southwards, to Savage Island, 19° S.

Hedley has published (pp. 272 – 276) an exhaustive account of the so-called "shark-hook" of the Pacific, and has shown that this peculiar wooden hook is not intended for shark but for Palu catching.

As these hooks are so commonly known to Ethnologists, and are found over such a large area, it might be thought that the fish for which they are intended would surely also be known. Palu fishing however, is conducted in a ceremonious and superstitious manner, and the natives are very jealous of their capture, which is "prized above all other fish." It is small wonder then that the Palu has so long remained unknown to Europeans, and indeed Becke writes: "With the exception of an old trader named Jack O'Brien, now living in Funafuti,* in the Ellice Group, I do not think there is among the white traders of to-day another man besides myself who has caught 'Palu.' In the first place, a man must have much experience of deep-sea fishing; in the next, the native inhabitants would strongly resent a strange white man attempting to catch one."

Taking all things into consideration it is not unreasonable to argue that where the Palu hook is found, thence will the fish, sooner or later be recorded.

"Tracing the geographical distribution of this hook (writes Hedley, p. 273), we note it recorded from Nanomea, by Brill; from Nukufetau in the Ellice, Nukuor in the Carolines, and Tarowa in the Gilberts, by Dr. Finsch; from Nukulailai, Nieue, Tamana, and the Union Group, and possibly an eccentric type

* Mr. O'Brien died in 1899, since the publication of Part 3 of this Memoir.

from the Louisiades, by Edge-Partington, and the latter also by Macgillivray; a drawing of a Penrhyn Island hook, by Wilkes, may be intended for this type; while a huge form is represented in the Australian Museum from the Mortlock Group, and another variation is pictured from the Trobriands by Finsch.* Another Palu hook has been described by Hedley,* as from Milne Bay, British New Guinea.

The distribution may thus be circumstantially extended north of the line to the Marshall Group thence westward to the Caroline Islands. About the same latitude, but south of the Equator, we include eastern New Guinea. The known eastern range may be extended a few degrees from Manahiki to Penrhyn Island.

The natives say that the Palu is never found among the high islands, such as the Fijis, Samoa, New Hebrides, etc.; and that it affects only the low-lying coral atolls. This statement may be explained (as Mr. Hedley suggests to me) as follows: The so called high islands have shelving shores so that a journey of twenty or even thirty miles might have to be undertaken in order to reach the depths frequented by the Palu, on the other hand the shores of the coral atolls are precipitous and deep water is sounded within a few miles of the coast.

When transcribing Becke's account the statement that the jaws are toothless, did not seem in harmony with the appearance of the palu hooks: these exhibit scratchings such as would be made by the teeth of a captured fish, and when examined the teeth of the specimen now received are just the kind to produce such marks. The general form of the hook is shown in the cut here reproduced (Fig. 58). Examples from the Mortlock Group exhibited in the Australian Museum are of enormous size, measuring seventeen and a half inches in length. Such suggest that they were prepared for the capture of much larger fish than those described.



Fig. 58.

The most graphic account of *Ruvettus pretiosus* available to me, is that by Goode and Bean, and the following is extracted from their "Oceanic Ichthyology":—"This form, first described from

* Hedley—Proc. Linn. Soc. N.S.W., xxii., 1898,, p. 288, pl. xiv.

the Mediterranean, occurs about Sicily; here it is so rare at the present time that it does not appear to have a common name among the fishermen, though Canestrini says that its flesh is delicious. Bonaparte refers to it as *Rovetto*, and the fishermen of Catania call it *Pesci Ruvette*. Dr. Anastasio Cocco first described it from Messina. Giglioli has observed it at Genoa, Naples, Palermo, Malta, and Spalato (Dalmatia) and at Nice. It was subsequently found by Lowe at Madeira, and by Webb and Berthelot at the Canaries. It occurs rarely on the Portuguese coast, where it is called *Escolar*, and doubtless also in Spanish waters. About the Canaries the fish is known as the *Escolar*, a name which is said to be applied to members of the family *Gadidae* by Spanish fishermen. The *Escolar* occurs in great schools about the Canaries in winter, and the fishermen capture it with hook and line at a depth of a hundred fathoms or less, and its flesh is highly prized. Cantraine states that it is taken at considerable depths about Malta. Lowe found it at Madeira at depths as great as 300 and 400 fathoms. It was found by Poey in the waters of Cuba before 1854. Poey tells us that it is rarely seen in the markets because of the difficulty attending its capture, for it can be caught only at a depth of 300 fathoms on dark nights in September and the early part of October. Poey further states that when one of these fishes is brought to the surface it appears to be surrounded by a globe of phosphorescent light. The Cuban fishermen go "a scholaring" (*à escolarear*) after the fishing for the Spearfish (*Tetrapturus*) has ceased, and before that for the Red Snapper (*Lutjanus aya*) begins. According to Canestrini it grows to the weight of 100 pounds in Sicilian waters."

Owing to mutilation the relative proportions of our specimen cannot be well ascertained, the following description is however not affected, excepting where the length of the body is concerned. As the body has been examined with the sawn vertebrae in proximity, such error as would be made in measuring the shrunken skin is avoided.

B. VII. D. XV. 18 + 2; A. 17 + 2; P. 14; V. I. 5; C. 9 + 8;
L. lat. 94. L. tr. 14 + 28.

Length of head 3·7, height of body 4·6 in the total length, (caudal excluded). Eye large, nearly round, 4·8 in the length of the head; interorbital space slightly convex, 3·7 in the head: snout 3·0 in the same. Anterior nostril vertically oval, situated one half nearer the eye than its distance from the end of the snout; posterior nostril, a deep vertical slit with a large valvular flap in front, one half nearer the eye than its distance from the anterior nostril. Two weak flat spines on the opercle of which the lower is the longer; at the angle of the preopercle are a number of minute soft denticulations. The maxilla measures half the length of the

head and extends to nearly beneath the posterior margin of the orbit, in the diameter of which its distal extremity is contained rather more than twice, and is rounded. Lower jaw the longer and very powerful. The skin covering the bony arch of the gills is studded with rough scales, and gill rakers are developed as needle-like spines most pronounced on the lower part of the upper and posterior part of the lower limb. The spines arise from a broad flattened base embedded in the skin on the outer side of the limb and moveable thereon, being attached each by a ligament. These bases bear from one to three spines and are placed at some distance apart, the scales between them are also minutely spiny. In the angle of the first and second arch is a large and strong obtuse process surmounted by two or more slender spines directed inwards.

The teeth are small, canine-like, set at some distant apart and curved inwards, red at the base; in the jaws they are arranged in a single row, those of the mandible being the larger. There are four comparatively large teeth on the premaxillary and three on the head of the vomer; a single row of teeth on the palatines similar to, but smaller than those of the jaws. The anterior pair of mandibular teeth are set forward and are entirely in front of the upper jaw. No teeth on the tongue.

The longest spines of the dorsal fin are equal in length to the diameter of the eye. The soft dorsal is similar to the anal, very high anteriorly; the rays one-third the length of the head. The pectoral is contained 2.2 and the ventral 3.4 times in the length of the head. The upper caudal lobe is slightly longer than the lower and is nine-elevenths the length of the head, the least depth of the pedicel is 5.9 in the same.

Scales. The whole head (including the lips and maxilla) and body are clothed with minute scales which average six or seven between each bony tubercle; these tubercles are rooted by long irregular rays, two or three in number, and the portion projecting from the skin is bi- or more usually trifurcate; surrounding the base of each tubercle is a number of pores, two being immediately in front. The lateral line is not very marked, but beneath the skin it is more easily traced; along this line the bony tubercles are much smaller, closer, and more deeply imbedded, producing a rather naked appearance. There are ninety-four plates along this line and fourteen and twenty-eight above and below it respectively, counting the transverse series.

Colours. Dark reddish-brown throughout, the bony scutes naked and white.

The dorsal and anal finlets are not separate as described and figured in Oceanic Ichthyology, and the last dorsal and anal rays not so completely attached as the preceding ones, a character correctly illustrated in the figure quoted. The anal fin commences further behind the origin of the dorsal than there shown. If the pores above referred to emit light, it seems very probable that the plates or tubercles serve as reflectors, and one may therefore readily believe Poey's statement (*vide* Goode and Bean) that when one of these fishes is brought to the surface it appears to be surrounded by a globe of phosphorescent light.

"Dr. Lütken calls attention to the fact that the *Gempylidæ* possess a system of dermal ribs or subcutaneous ribs, composed of slender bony filaments close-set, directed backward and upward, and backward and downward from the median line. This character has been verified in *Thyrsites*, *Nealotus*, and *Gempylus*."*

Our example of *Ruvettus* possesses similar bones but apparently of simpler type: they extend from behind the head to nearly the middle of the spinous dorsal beyond which point they cannot be traced. Situated immediately beneath the lateral line they are directed backwards and upwards, and appear to be the ossified terminations of the ligaments which arise from the vertebrae.

How nearly the habits of the fish in the Pacific coincide with the accounts of writers on Atlantic specimens the following comparison will show.

In the "Atoll of Funafuti" the Palu is described as being caught only in the deepest water and while Mr. Louis Becke remarks that it is not unusual to fish in one hundred and fifty to two hundred fathoms, he cites as remarkable that he once caught five Palu in one night, in *eighty fathoms* only. All Palu are fished for at night.

The Escolar, (Atlantic name) has been taken at depths as great as three hundred and four hundred fathoms, and can be taken only at night in September and the early part of October.

The Palu or Oil Fish as it is also called (both in the Pacific and the Atlantic) is prized above all other fish, and its effect as a purgative has earned for it the name 'Te icka ne peka' by the Line Islanders. Of the Escolar, Lowe† writes:—"The flesh of this very singular species is said to be extremely rich, and the bones, it is affirmed, abound in an oil or marrow, which, when they are sucked incautiously, produces speedy diarrhœa."

* Jordan and Evermann—Bull. U. S. Nat. Mus., No. 47, 1896, p. 877.

† Lowe—Fishes of Madeira, Trans. Zool. Soc., ii. p. 181.

Additional fishes not obtained by the original expedition are as follows :—

SERRANIDÆ.

EPINEPHELUS, *Bloch.*

EPINEPHELUS FUSCOGUTTATUS, *Forsk.*

Epinephelus fuscoguttatus, *Forsk., sp.*, *Descr. Anim.*, p. 42; *Playf.* and *Günth.*, *Fish. Zanzibar*, p. 6, pl. i., figs. 2 and 3.

The species is represented by a single immature example measuring only 50 mm. in length. Funafuti forms another station for this widely distributed form, connecting the Marshall Group with the Samoan and Friendly Isles, whence it has been previously recorded.

GRAMMISTES, *Artedi.*

GRAMMISTES SEXLINEATUS, *Thunb.*

Grammistes sexlineatus, *Thunb. sp.*, *Vetensk. Ac. Handl. Stockh.* xiii., 1792, p. 142, pl. v.; *Day, Fishes of India*, p. 28, pl. ix., fig. 1.

Though the only example received measures but 21 mm. in length, the striking features of the species (the only one of its genus) renders identification unmistakable. The usual longitudinal white lines are broken up into spots, and all the anal rays are articulated, a character which separates it from *Pogonoperca*, wherein anal spines are noticeably developed.

CHÆTODONTIDÆ.

ZANCLUS, *Cuv. and Val.*

ZANCLUS CORNUTUS, *Linn.*

Zanclus cornutus, *Linn., sp.*, *Günth.*, *Fische der Südsee*, p. 142, pl. xcii.

The solitary specimen obtained is about the size of the young figured by *Günther*. The anterior black band is however continued to the ventral profile, as in the adult.

BLENNIIDÆ.

SALARIAS, *Cuv.*

SALARIAS PERIOPHTHALMUS, *Cuv. and Val.*

Salarias periophthalmus, *Cuv. and Val.*, *Hist. Nat.*, xi., p. 311, pl. cccxxviii.; *Günth.*, *Fische der Südsee*, p. 207, pl. cxiv., figs. D and E.

Two examples are to hand, each about the size of *Günther's* fig. D. The only variation is in the markings of the fins. The

red dots on the dorsal are not observable and the spinous portion is ornamented near its edge with a series of black blotches, one to each spine. These did not occur in Günther's specimens neither did a dark vertical mark at the base of every third spine and ray throughout the whole length of the dorsal fin.

PLEURONECTIDÆ.

PLATOPHRYS, *Swains.*

PLATOPHRYS PANTHERINUS, *Rüpp.*

Platophrys pantherinus, Rüpp., Atlas Fische, p. 121, pl. xxxi. fig. 1; Day, Fishes of India, p. 425, pl. xcii., figs. 3 and 4.

The small specimen obtained differs from Day's figure (fig. 3) by having the anterior dorsal rays free for half their length, and by having white spots on the vertical and caudal fins, a feature however mentioned in the description. In addition, the vertical fins have small black spots at intervals near the base of the rays, apparently similar to *P. nebularis*, Jord. and Gilb.* In April, 1898, I obtained *P. pantherinus* at Lord Howe Island.

DIODONTIDÆ.

TETRODON, *Linnaeus.*

TETRODON MARGARITATUS, *Rüpp.*

Tetrodon margaritatus, Rüpp., Atlas Fische, p. 66; Richards, Voy. Samarang, Fish, p. 20, pl. ix., figs. 1 and 2.

This widely distributed and variable species is represented by two small examples; they agree most nearly with the variety described as *T. papua*.

* Jordan and Gilbert—Proc. U.S. Nat. Mus., vii., 1884, p. 31.

THE MOLLUSCA OF FUNAFUTI.

(SUPPLEMENT.)

By CHARLES HEDLEY,

Conchologist, Australian Museum.

THE MOLLUSCA OF FUNAFUTI.

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IN the year 1897, a second, and in 1898, a third expedition visited the Atoll of Funafuti in prosecution of the attempt to carry a bore through the coral formation. The mollusca herein described were obtained by these parties, chiefly by deep dredging, and were remitted to the Australian Museum by the Local Funafuti Committee of the Royal Society. This material reached the Writer too late for incorporation in the body of this Memoir. The results of a study of it are accordingly presented in this appendix.

This material is of importance since it illustrates a side of the Funafuti zoology which I had little opportunity of investigating personally, viz., that of the deeper water. Dredgings carried out by Mr. G. H. Halligan in one hundred and fifty fathoms, and again in two hundred fathoms, produced results of especial interest. In the latter depth he discovered a bed of the typical "Pteropod Ooze." The sample of his dredgings submitted to me, might have stood for the portrait of that deposit figured by Murray and Renard.*

This ooze has been chiefly studied in the Atlantic, and though its equal distribution in the Pacific is a matter of course, the present record is an interesting extension of the known range.

But the chief claim that this deposit has on our attention is that it appears in water of less depth than in any instance known heretofore. The least depth in which the "Challenger" obtained Pteropod Ooze was in 390 fathoms, the greatest 1,525 fathoms, the average being 1,044 fathoms.†

The following species already noted as from surface waters again occurred in greater depths:

Teinostoma tricarinatum—150 fathoms off Beacon Islet (Funamanu), and 36 fathoms north of Pava Islet.

Cisonella ovata—150 fathoms off Beacon Islet (Funamanu).

Stomatella sanguinea—36 fathoms N. 30° West of Pava, 45 - 52 fathoms off Tutaga Islet.

*Murray and Renard—Chall. Rep., Deep Sea Deposits, 1891, pl. xi. fig. 6.

† Murray and Renard—loc. cit., p. 225.

Cæcum vertebrale—off Tutaga in 45–52, 50–60, and 200 fathoms; off Beacon Islet (Funamanu), at 150; and in 36 fathoms north; and 36 fathoms N. 30° W. of Pava. This is evidently from its abundance a native of the deeper water. Some of the examples from 150 and 200 fathoms have a few brown blotches on the shell.

Cæcum gulosum—dredged at every station with *C. vertebrale*.

Columbella varians—36 fathoms N. 30° W. of Pava.

Marginella iota—36 fathoms N. 30° W. of Pava, off Beacon Islet (Funamanu) in 150, and off Tutaga in 45–52 and 200 fathoms.

Marginella sandwicensis—150 fathoms off Beacon Islet (Funamanu).

Olivella simplex—36 fathoms N. of Pava.

Those species which are either new to science or have not been yet recorded from Funafuti are as under.

CEPHALOPODA.

OCTOPUS TONGANUS, Hoyle.

Hoyle, Chall. Rep., Zool., xvi., 1886, p. 83, pl. viii., figs. 1, 2.

One male specimen was procured in the lagoon by Mr. A. E. Finckh. The species has only been found before at Tonga.

POLYPLACOPHERA.

TONICIA *sp.*

(Fig. 59.)

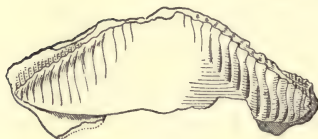


Fig. 59.

A single mutilated median valve of a Chiton was obtained at a depth of 150 fathoms off Beacon Islet (Funamanu). Such features as it has, point to an affinity with *T. confossa*, Gould. The rarity of this group in

the Central Pacific renders the occurrence of this fragment noteworthy. Only six species were known to Harper Pease from the Central Pacific. In his last paper he stated that,—“The absence of Chitonidæ from Polynesia has been noticed by authors as a remarkable fact, abounding as they do* in the surrounding provinces, especially on the west coast of America, at Australia and New Zealand.”†

* The Chitons not the authors.

† Pease—Am. Journ. Conch., vii., 1872, p. 194.

SCAPHOPODA.

CADULUS ARATUS, *sp. nov.*

(Fig. 60.)

Shell short and stout, slightly swollen and gently tapering to either end, on one side almost straight, on the other arcuate, glossy and almost transparent. In one case the translucent ground is mottled with opaque white spots. Four longitudinal equally spaced furrows impress the surface. Anal end bilabiate, the lips usually widely parted, that on the straighter side projecting beyond its fellow. In one case the lips are of equal length almost touching distally and divided by a narrow slit. Aperture very oblique with a small thickened rim. Length 3·4; breadth ·64 mm. Another specimen, length 2; breadth ·48 mm.

Dredged 36 fathoms north of Pava Islet; 36 fathoms N. 30° W. of Pava Islet; 50–60 fathoms off Tutaga Islet and 150 fathoms off Beacon Islet (Funamanu).

The Fijian *C. dichelus*, Watson, a near relative, is twice as large, more bent and unfurrowed.



Fig. 60.

GASTEROPODA.

SCISSURELLA EQUATORIA, *sp. nov.*

(Fig. 61.)

Shell large for the genus, thin, trochiform, with gradate spire; frilled, projecting keels; compressed belt below the fasciole, and tumid base. Colour white. Whorls five. Sculpture—about eighty five, curved, oblique, lamellate ribs cross the whole shell. Above, the spiral sculpture can hardly be traced, but on the base it is distinguishable as delicate, widely spaced threads overriding the ribs and latticing the interspaces. Fasciole enfolded by broad margins, which are fimbriated by the ribs. Umbilicus narrow, infundibuliform, deep. Aperture oblique, subquadrate; lip slightly and gently recurved; columella margin explanate and reaching over the umbilicus. Major diameter 3, minor 2·5; height 2·68 m.m.

One specimen dredged off Tutaga Islet in 200 fathoms.

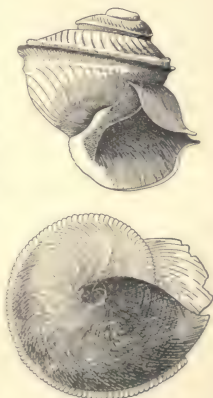


Fig. 61.

This, the largest species of the genus, seems very close to *S. aedonia*, Watson, from which I separate it by the contracted zone beneath the fasciole, larger size and less development of spiral sculpture.

SCHISMOPE PLICATA, *sp. nov.*

(Fig. 62.)

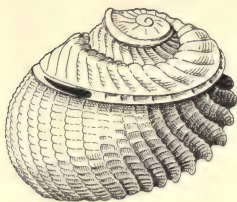


Fig. 62.

Shell large for the genus, thin, subglobose, flattened above. Colour cream. Whorls three, rapidly increasing. Earlier whorls wound in the same plane, the last steeply descending, sharply angled at the fasciole, compressed and then inflated beneath it. Umbilicus moderate in width, deep, with smooth walls. Sculpture—both above and below the fasciole the shell is ornamented by about twenty-two prominent longitudinal ribs, which project

most beneath the fasciole half a whorl behind the mouth, from thence on they diminish considerably. These are overridden by close, sharp, raised, spiral lines, which cross the interstices and denticulate the crests of the ribs. Slit pointed anteriorly, rounded posteriorly, in length about a sixth of the circumference of the shell. The fasciole, a broad gutter with raised margins, its trough septate by continuations of the longitudinal ribs, ascends the spire for a whorl and a half, as in other Pacific species. Aperture ovate, columella slightly reflected. Major diameter 2.3, minor 1.7; height 2 mm.

Dredged off Beacon Islet (Funamanu), in 150 fathoms, and off Tutaga in 150 and 50–60 fathoms.

This species stands nearest to *S. ferriezi*, Crosse, from which it is clearly distinguished by a more elevated spire, coarser sculpture and larger size.

TEINOSTOMA QUALUM, *var. PAUCICOSTATUM*, *var. nov.*

(Fig. 63.)

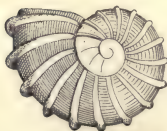


Fig. 63.

Under this varietal name is distinguished a specimen, which, though probably immature is larger than the type, measuring in major diameter 2 and in minor 1.32 mm. It has the same detail sculpture but carries sixteen ribs on the last whorl instead of twenty. The chief distinction however is that the ribs are continued to the suture instead of terminating at a distance therefrom as in the type.

Dredged at 150 fathoms off Beacon Islet (Funamanu).

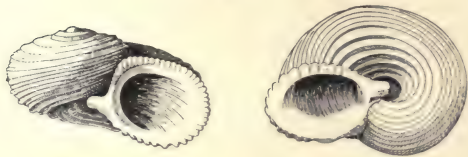
HALIOTIS OVINA, Chemnitz.

Pilsbry, Man. Conch., xii., 1890, p. 125, pl. xix., figs. 7, 8.

A specimen was obtained at Funafuti by Mr. A. E. Finckh.

TEINOSTOMA PARVULUM, *sp. nov.*

(Fig. 64.)



Shell minute, solid, depressed turbate, with slightly elevated spire. Colour cream. Whorls four. Sculpture—about fourteen elevated, spiral lyræ which are weaker and widest apart above and closer and stronger towards the umbilicus. Above and on the periphery, their interstices are occupied by one or two fine spiral threads. No transverse sculpture is apparent. Base rounded. Umbilicus oblong, narrow, deep; the basal sculpture winding obliquely into it. Aperture oblique, circular, with a smooth, inner, raised margin and a stout varix alternately and evenly grooved and ridged by the spiral sculpture. The left lower margin of the varix is produced in a tongue over the umbilicus. Major diameter 1.14, minor 1; height .8 mm.

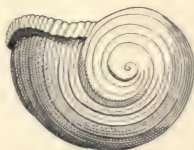


Fig. 64.

One specimen dredged in 36 fathoms north of Pava Islet.

This species, the least of the genus to which I have assigned it, has an equal claim to be placed in *Liotia*. The subumbilical tongue, a rather artificial feature, has governed the present generic disposition.

TEINOSTOMA ROTATUM, *sp. nov.*

(Fig. 65.)

Shell small, perforate, subdiscoidal. Colour white. Whorls three and a half, rounded, gradually increasing, last descending



Fig. 65.

and contracting at the aperture. First two whorls smooth, the rest sculptured by about forty, fine, close, even, flat-topped, spiral lyreæ; parted by sharp, narrow interstices. On the base are eight, raised, radiating bars of callus, unevenly set round the umbilicus, like the spokes of a wheel. A fifth of a whorl behind the aperture the scar of a former aperture has left a kind of varix. Umbilicus small, its margin crenulate. Aperture oblique, circular, entire; left margin barely recurved; lower right margin advancing over the umbilicus in imbricating callous tongues; upper right margin linked to the preceding whorl by a V-shaped callous ridge. Major diameter 1.86, minor 1.76; height 1.16 mm.

One specimen dredged in 200 fathoms off Tutaga Islet.

By its small size and peculiarly sculptured base, this species is sufficiently distinguished from the remainder of the genus.

LIOTIA sp.

(Fig. 66.)

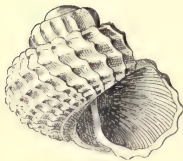


Fig. 66.

Shell globose, rather flattened on the base. Colour cream. Whorls three. Sculpture—eight equally spaced spiral lyreæ, cancellated by the intersection of about eighteen longitudinal ribs of equal size. Umbilicus narrow. Aperture unfinished. Major diameter 1.16, minor 1.6; height 1.16 mm.

One specimen in 200 fathoms off Tutaga Islet.

This shell, though not adult, is evidently new. Its future recognition should be ensured by the remarkable sculpture. Probably it belongs near *Liotia* and possibly to the new genus *Mecoliotia*. Until the important characters of the aperture are known, no good end would be served by bestowing on it a specific name.

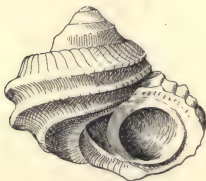


Fig. 67.

LIOTIA PARVISSIMA, sp. nov.

(Fig. 67.)

Shell minute, solid, turbanate. Colour cream. Whorls four. Sculpture—a heavy, elevated keel on the shoulder, two equally massive on the periphery, and two smaller on the base. Across keels and interstices run distant, longitudinal, raised threads. Umbilicus small, oblique narrow and deep. Aperture, circular, oblique, with a short but

heavy varix, crenulated by the spiral sculpture. Major diameter .84, minor .66; height .84 mm.

Dredged off Tutaga Islet at a depth of 200 fathoms, and off Beacon Islet (Funamanu) at 150 fathoms.

This, the smallest known *Liotia*, is well distinguished by its simple and massive sculpture.

MECOLIOTIA, *gen. nov.*

A genus of the Liotiidae, distinguished from *Liotia* by an elevated spire of six whorls, an obliquely truncate base and granose sculpture.

The type species appears to me to be co-generic with *Iphitus tuberculatus*, Watson.* The genus *Iphitus* was founded by Jeffreys on a single immature specimen,† and is known from Watson's rather than from Jeffreys' account. Jeffreys placed the genus in the Littorinidae and Fisher in the Fossaridae. My species cannot enter either of these families, nor, I should think, could *I. tuberculatus*. We are however, relieved from the unsatisfactory genus of Jeffreys by the fact that *Iphitus* is preoccupied in Mollusca by Rafinesque.‡ In Hemiptera Stål introduced *Iphita* in 1870.§

Type, *Mecoliotia halligani*.

MECOLIOTIA HALLIGANI, *sp. nov.*

(Fig. 68.)

Shell small, most massive, conical, with obliquely truncate base, narrowly perforate. Colour white. Whorls six of which two are apical, separated by deeply impressed sutures. Sculpture—the third has one, the fourth and fifth each two, and the last whorl three, prominent, heavy, spiral keels. These are overridden and knotted by longitudinal ribs, which on the last whorl number seventeen, cross from umbilicus to suture, and mount the upper whorls perpendicularly and continuously. Deep square pits are enclosed by the intersection of this sculpture. The first whorl is rounded, the second keeled. The base is hollow beneath the periphery, with a central

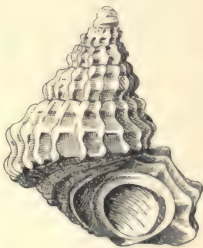


Fig. 68.

* Watson—Chall. Rep., Zool., xv., 1886, p. 583, pl. xlv., fig. 5.

† Jeffreys—Proc. Zool. Soc., 1883, p. 113, pl. xx., fig. 12.

‡ Rafinesque—Anal. Nat., 1815, p. 141.

§ Stål—Sv. Ak. Handl., 1870, p. 99.

nodose lyra, then a furrow, followed by the smooth raised margin of the narrow oblique umbilicus. Aperture, oblique, circular with a double lip, one within the other, and an expanded, trifold wing-like varix. Length 1·6; breadth 1·4 mm.

One specimen dredged off Tutaga Islet in 50 – 60 fathoms.

Named in honour of Mr. G. H. Halligan, who procured most of the deeper water species mentioned in this supplement.

EULIMA DIAPHANA, *sp. nov.*

(Fig. 69.)



Fig. 69.

Shell narrow, subulate, transparent. Whorls seven, rapidly increasing, wound more obliquely as the growth proceeds. Surface smooth, most glossy, through it is seen every detail of the columella. Aperture somewhat claw-shaped, narrow and curved, acuminate posteriorly, broadest and truncate anteriorly. Outer lip sharp sinuous. Columella slightly curved, spreading a callus on the preceding whorl. Length 1·8; breadth ·44 mm.

One specimen dredged at 45 – 52 fathoms off Tutaga.

This species appears to be widely different from any hitherto figured.

EULIMA SAMOENSIS, *Crosse*.

Tryon, *Man. Conch.*, viii., 1886, pl. lxx., fig. 78.

One specimen collected by Mr. W. Poole on the lagoon beach was by him presented to the Australian Museum. The species was previously only known from Samoa.

ODONTOSTOMIA ROBUSTA, *sp. nov.*

(Fig. 70.)

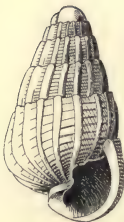


Fig. 70.

Shell small, strong, ovate. Colour white. Whorls four; exclusive of the smooth, prostrate, heterostrophic two-whorled apex. Sculpture—sixteen strong, smooth, outstanding, longitudinal ribs sinuate the suture and reach to the extreme point of the base. Similar ribs extend continuously across the upper whorls. Between these ribs appear the broken lengths of about a dozen, delicate, widely parted, raised, spiral threads. Aperture ear-shaped, effuse anteriorly. Columella massive, entering in a strong, spiral twist. Lip formed by the last rib. Length 1·2; breadth ·65 mm.

One specimen dredged off Tutaga Islet in 45 – 52 fathoms.

This species is most like *O. oodes*, Watson, from which it is separated by more conical shape, fewer ribs and different apex.

ODONTOSTOMIA BIPLICATA, *sp. nov.*

(Fig. 71.)

Shell oblong-ovate, imperforate, white. Whorls three and an inrolled vertical and half buried apex, slightly gradate, separated by a channeled suture. Upper whorls angled and contracted above the suture. Last whorl slightly angled at the periphery. Sculpture—last whorl with two small, but sharp revolving ridges, one at the periphery and the other below the suture, both ascending the earlier whorls. Upper whorls otherwise smooth, final whorl furrowed spirally by about twenty-five fine close grooves beneath the periphery. Aperture ovate, acuminate above and below. Deep within the throat and confined to the posterior moiety, are five strong revolving ridges, the remainder of the throat is grooved by small revolving striae, answering to the externals culpture. Lip sharp, simple, produced anteriorly. Columella with a heavy, median, transverse fold, posterior to which is another deeper oblique fold. Length 1.46; breadth .7 mm.

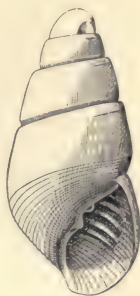


Fig. 71.

One specimen dredged at 36 fathoms north of Pava Islet.

This is a well marked species. Not only is it smaller than any enumerated in Tryon's Monograph, but the second, deep seated columella fold seems to be unmatched in the genus. The ridges in the throat occur in some species from the Red Sea.

RISSEO FINCKHI, *sp. nov.*

(Fig. 72.)

Shell narrow, subulate, turretted, massive, small. Colour white with a yellow apex. Whorls eight. Sculpture—round the periphery of each whorl is wound a heavy tabulate keel. The penultimate whorl carries a spiral thread above and another below this keel. On the last whorl is a raised subsutural thread and three basal lyræ. Aperture oblique, circular, peristome entire, thickened and broadly reflected. Length 1.92; breadth .92 mm.

One specimen dredged off Tutaga Islet in 200 fathoms.

Named in honour of Mr. A. E. Finckh, who made zoological collections on Funafuti



Fig. 72.

in 1898, when in charge of the Diamond Drill Boring Expedition.

RISOO POOLEI, *sp. nov.*

(Fig. 73.)

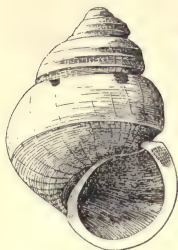


Fig. 73.

Shell broadly ovate. Whorls four. Colour white with a few subsutural orange dots, one of which occurs on the lip and three on the remainder of the last whorl. Sculpture—the last whorl is angled at a weak spiral rib on the periphery. Proportionately stronger are three on the penultimate, and two on the antipenultimate, similar spiral ribs. The whole shell is closely covered by minute, close, wavy, spiral threads which are overridden by faint, close, longitudinal sculpture extending across the whole whorl. Umbilicus small, covered by the columella. Aperture

round, rather oblique. Lip massive, expanded and broadly reflected with a second lip or varix close behind. Columella broad appressed. Length .95; breadth .66 mm.

Dredged off Tutaga Islet at depths of 45 – 52, 50 – 60, and 200 fathoms; off Beacon Islet (Funamanu) at 150 fathoms; and north of Pava Islet at 36 fathoms.

The affinities of this shell are with the species previously described from Funafuti as *Risoo invisibilis*. It is named in honour of Mr. William Poole, B.A., a volunteer assistant of the second expedition to Funafuti.

DIALA PROFUNDA, *sp. nov.*

(Fig. 74.)



Fig. 74.

Shell subulate, thin. Colour, the figured example has the first four whorls ochraceous, the next two almost white, the last two ochraceous buff with the columella and lip tawny; another specimen is uniform dark brown. Whorls eight. The apex smooth and blunt; the third and fourth whorls with two raised spiral cords each, the remaining whorls angled above and below the suture. Surface smooth and shining. Aperture perpendicular, angled above, rounded below; outer lip straight and sharp; columella reflected over a minute perforation. Length 1.9; breadth .66 mm.

Dredged off Tutaga Islet at depths of 45 – 50, 50 – 60 and 200 fathoms; and in 36 fathoms north and 36 fathoms N. 30° W. of Pava Islet.

CÆCUM AMALTHEANUM, sp. nov.

(Fig. 75.)

Shell small, a twisted cone, performing about a third of a revolution, rapidly enlarging. White very glossy, with about twenty, faint rib rings. Aperture circular, slightly contracted behind the everted lip. Septum gradate, with three steps, arising deep within the collar, peaked on the outer side. Length .76; breadth at aperture .34 mm.

Two examples dredged at 36 fathoms, north of Pava Islet.

The contour of this species isolates it from any co-generic type.

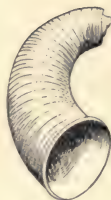


Fig. 75.

CÆCUM LEGUMEN, sp. nov.

(Fig. 76.)

Shell pod-shaped, arched on one side, nearly straight on the other; rounded in transverse section on the arched side and flattened on the straight. Colour white. Sculptured by fine growth rings, surface glossy and shining. At the aperture slightly contracted, mouth oval, flattened on one side. Septum much exerted, peaked on the curved side. As foreshortened to show the aperture in my drawing, the shell has a quaint resemblance to a tobacco pipe. Length 1.5; breadth .64 mm.



Fig. 76.

Dredged at 36 fathoms N. 30° W. of Pava Islet and again at 150 fathoms off Beacon Islet (Funamanu).

The only species at all resembling this, figured in Tryon's Manual, is *C. nitidum*, Stimpson, than which it is less inflated.

TRIFORIS ASPERRIMUS, Hinds.

(Fig. 77.)

Hinds, Ann. Mag. Nat. Hist., xi., 1843, p. 18; Tryon, Man. Conch., ix., 1887, p. 181, pl. xxxviii, fig. 6.

A single, probably immature, specimen of twelve whorls, in length 2.92 and in breadth .56 mm., which was dredged in 36 fathoms, north of Pava Islet is thus doubtfully determined. The species appears not to have been seen since Sir Edward Belcher dredged his unique specimen in eight fathoms on the Papuan coast.



Fig. 77.

MUREX RAMOSUS, Linne.

Tryon, Man. Conch., ii., 1880, p. 95, pl. i., figs. 1, 2.

A specimen was obtained by Mr. A. E. Finckh on one of the leeward islets of Funafuti.

CYPRÆA BECKI, Gaskoin.

Tryon, Man. Conch., vii., 1885, p. 91, pl. xvii., figs. 86, 87.

One specimen collected by Mr. W. Poole on the lagoon beach of Funafuti.

TURRICULA EXASPERATA, Gmelin.

Tryon, Man. Conch., iv., 1882, p. 180, pl. liii., figs. 541 - 544, pl. liv., figs. 545 - 546.

One dead shell dredged in 36 fathoms N. 30° W. of Pava Islet.

MARGINELLA ISSELI, Nevill, var. ELLICENSIS, var. nov.

(Fig. 78.)



Fig. 78.

Shell small, ovate, white, smooth, with a buried spire. Aperture narrow, crescentic. Outer lip arching from and above the vertex, thickened without and finely crenulate within, channeled anteriorly. Inner lip with a heavy layer of callus edged abruptly. Columella with three oblique entering folds, the posterior one small. Length 1.4; breadth .64 mm.

Dredged at 36 fathoms north of Pava Islet; at 36 fathoms N. 30° W. of Pava Islet, and at 150 fathoms off Beacon Islet (Funamanu)

After much perplexity I have concluded not to separate this specifically from *M. isseli*, Nevill,* which agrees in size and shape but apparently differs by an additional fold on the columella. The example of that which Issel examined† had not the crenulated lip of the type. Savigny's work, containing the original description, is unfortunately inaccessible to me. No distinction is apparent to me between this species and *M. nymphe*, Brazier,‡ from Sydney Harbour,

Examples from Cape Sidmouth, Queensland, of what appears to be another variety of *M. isseli* are before me. They agree in shape but differ by being 2 mm. in length, and by having five plications on the columella.

* Tryon—Man. Conch., v., 1883, p. 40, pl. xi., fig. 39.

† Issel—Malac. del Mar Rosso, 1869, p. 117.

‡ Brazier—Proc. Linn. Soc. N. S. W., (2) ix., 1894, p. 168, pl. xiv., fig. 2.

PTEROSOMA PLANA, Lesson.

Hedley, Proc. Malac. Soc., i., 1895, p. 333; Crosse, Journ. de Conch., xliv., 1896 (1897), pp. 207 - 212.

An imperfect shell from a depth of 200 fathoms off Tutaga Islet, is with doubt so identified. Since writing the article above quoted I have found that Fischer's reason for classing this as a Nemertine was a mistaken identification by the Naturalists of the "Challenger."*

ATLANTA GIBBOSA, Eydoux and Souleyet.

Eydoux and Souleyet, Voy. Bonite, Zool., ii., 1841, p. 386, pl. xxi., figs. 1 - 8.

Dead shells were dredged off Tutaga, in 45 - 52 and 200 fathoms. This species does not seem to have been recorded from the Pacific.

ATLANTA TURRICULATA, D'Orbigny.

Eydoux and Souleyet, *loc. cit.*, p. 391, pl. xxi., figs. 30 - 35.

Dredged off Tutaga Islet in 45 - 52 and 200 fathoms.

ATLANTA GUIDICHAUDII, Eydoux and Souleyet.

Eydoux and Souleyet, *loc. cit.*, p. 397, pl. xix., figs. 29 - 34.

Several dead shells dredged in 200 fathoms off Tutaga Islet.

TORNATINA LEPTOKES, Watson.

Pilsbry, Man. Conch., xv., 1893, p. 200, pl. xxiv., figs. 29, 30.

Dredged in 36 fathoms north of Pava Islet, and off Tutaga in 45 - 52 and 200 fathoms.

Previously taken off Raine Island, Queensland, by the "Challenger,"

RINGICULA, *sp.*

A small *Ringicula* was dredged in 45 - 52 fathoms off Tutaga Islet. It corresponds exactly to specimens from Torres Straits, which I have identified as *P. pusilla*, Watson, and differs very little from my *R. parvula*. It may be here pointed out that the illustration of *R. pusilla*,† appears to represent a young and broken shell, and that the description conveys a totally different idea of the species.

* Moseley—Ann. Mag. Nat. Hist., (4) xvi., 1875, p. 382.

† Watson—Chall. Rep., Zool., xv., 1886, pl. xlvi., fig. 9.

RINGICULA INCISA, *sp. nov.*

(Fig. 79.)

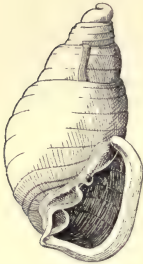


Fig. 79.

Shell ovate, glossy. Whorls five. Colour white. Sculpture—girt around the last whorl are eight nearly equidistant sharp furrows, sloping above and cut square below so as to carve the surface into descending steps. On the upper whorls there are three furrows. A distinct varix marks the penultimate whorl. Aperture ear-shaped, effuse and truncate anteriorly. Outer lip broadly reflected, rather straight, without tubercles. Inner lip with broad and strong plications below and a small one above. Length 2.2; breadth 1.2 mm.

One specimen dredged in 36 fathoms N. 30° W. of Pava Islet.

PHYLLIDIA VARICOSA, *Lamarck*.

Bergh, Reis. Archip. Philippinen, ii., 1876, p. 380, pl. lxxxvi., fig. 11.

Three specimens were collected by Mr. A. E. Finckh in the Funafuti lagoon.

CRYPTOPHTHALMUS SMARAGDINUS, *Leuckart*.

Pilsbry, Man. Conch., xvi., 1895, p. 37, pl. vi., figs. 29 – 36.

Two specimens were taken by myself alive in shallow water in the lagoon. Mention of them was inadvertently omitted from preceding pages. With them were taken an undetermined *Doris*, and an *Eolis*.

LIMACINA INFLATA, *D'Orbigny*.

H. and A. Adams, Genera Recent Mollusca, iii., 1858, pl. cxxxvii., figs. 2, 2a, 2b; Pelseneer, Chall. Rep., Zool., xxiii., 1888, p. 17.

Dead shells were dredged in abundance, off Tutaga Islet, in 45 – 52, 50 – 60, and 200 fathoms; in 36 fathoms north and in 36 fathoms N. 30° W. of Pava; and in 150 fathoms off Beacon Islet (Funamanu).

LIMACINA BULIMOIDES, *D'Orbigny*.

Rang and Souleyet, Hist. Nat. Pteropodes, 1852, p. 65, pl. xv., figs. 1 – 7; Pelseneer, *loc. cit.*, p. 30.

Dead shells dredged plentifully off Tutaga Islet in 36, 45 – 52 and 200 fathoms, and N. 30° W. of Pava Islet in 36 fathoms.

CLIO VIRGULA, *Rang*.

Rang and Souleyet, *loc. cit.*, p. 57, pl. vi., fig. 2, pl. xiii., figs. 20 – 24; Pelseneer, *loc. cit.*, p. 48.

A few shells dredged off Tutaga Islet in 45 - 52 and 200 fathoms and off Beacon Islet in 150 fathoms.

CLIO ACICULA, Rang.

Rang and Souleyet, *loc. cit.*, p. 56, pl. vi., figs. 5, 7; Pelseneer, *loc. cit.*, p. 51.

A few dead shells dredged in 200 fathoms off Tutaga Islet.

CLIO STRIATA, Rang.

Rang and Souleyet, *loc. cit.*, p. 55, pl. vi., fig. 3; Pelseneer, *loc. cit.*, p. 51.

One broken specimen from 45 - 52 fathoms off Tutaga Islet.

CLIO SUBULA, Quoy and Gaimard.

Rang and Souleyet, *loc. cit.*, p. 55, pl. vi., fig. 1; Pelseneer, *loc. cit.*, p. 57.

Numerous dead shells dredged off Tutaga Islet in 45 - 52 and 200 fathoms.

CLIO PYRAMIDATA, Linne.

Rang and Souleyet, *loc. cit.*, p. 50, pl. v., figs. 7 - 11; Pelseneer, *loc. cit.*, p. 63.

Dredged off Tutaga Islet in 45 - 52 and 200 fathoms.

CUVIERINA COLUMNELLA, Rang.

Boas, *Spolia Atlantica*, 1885, pl. iii., fig. 39; Pelseneer, *loc. cit.*, p. 67.

One specimen dredged in 200 fathoms off Tutaga Islet.

CAVOLINIA QUADRIDENTATA, Lesueur.

Boas, *loc. cit.*, p. 99, pl. i., fig. 4, pl. ii., fig. 15; Pelseneer, *loc. cit.*, p. 78.

A few dead specimens dredged off Tutaga Islet, in 45 - 52 and 200 fathoms.

CAVOLINIA LONGIROSTRIS, Lesueur.

Boas, *loc. cit.*, p. 102, pl. i., fig. 5, pl. ii., fig. 16; Pelseneer, *loc. cit.*, p. 79.

One dead specimen dredged in 200 fathoms off Tutaga Islet.

CAVOLINIA INFLEXA, Lesueur.

Boas, *loc. cit.*, p. 123, pl. i., fig. 11, pl. ii., fig. 21; Pelseneer, *loc. cit.*, p. 85.

Dredged off Tutaga Islet in 45 - 52 and 200 fathoms.

AGADINA STIMPSONI, A. Adams.

Pelseneer, *loc. cit.*, p. 31, pl. i., figs. 11 - 14.

A few specimens dredged off Tutaga Islet in 45 - 52 and 200 fathoms and north of Pava in 36 fathoms.

PELECYPODA.

ARCA PTEROESSA, Smith.

Smith, Chall. Rep., Zool., xiii., 1885, p. 262, pl. xvii., fig. 4.

Two small separate valves were dredged at 200 fathoms off Tutaga Islet.

ARCA CONGENITA, Smith.

Smith, *loc. cit.*, p. 264, pl. xvii., fig. 6.

One small valve from 50 - 60 fathoms off Tutaga Islet.

LIMOPSIS DAVIDIS, sp. nov.

(Fig. 80.)

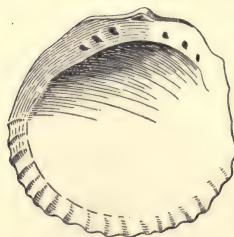
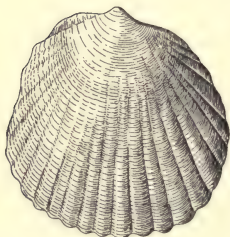


Fig. 80.

Shell small, suborbicular, flattened, scarcely inequilateral. Colour white, with a few, small, scattered brown dots. Posterior margin truncate; ventral and anterior margins rounded. Umbo prominent. Epidermis denuded. Sculpture—about twenty-four, prominent, radiating ridges sharply crenulate the margin and fade away before reaching the umbo, these are separated by flat interstices of about twice their breadth. They are more prominent and closer together at the postero-ventral side, but for a space in the posterior slope one or two seem missing. The whole valve is covered with close concentric wrinkles, which become coarser as the ventral margin is approached. Hinge area very broad and rather curved, teeth three on each side. Internal margin crenulate. Height 1.22, length 1.22 mm.

One valve from 45 - 52 fathoms off Tutaga Islet.

Named in honour of Prof. T. W. E. David, B.A., under whose auspices it was secured.

If adult this species is the smallest known member of the genus. In several respects it approaches *L. antillensis*, Dall,* which is deeper, and has certain internal tubercles absent in *L. davidis*.

LIMEA PECTINATA, *H. Adams*.

H. Adams, Proc. Zool. Soc., 1870, p. 7, pl. i., fig. 11.

One valve from 36 fathoms N. 30° W. of Pava.

This is the first appearance of either species or genus in the Pacific.

PECTEN SPECIOSUS, *Reeve*.

Reeve, Conch. Icon., viii., pl. xxvii., sp. 112.

One living example was taken in the lagoon by Mr. A. E. Finckh.

CRASSATELLA *sp.*

A fragment of a *Crassatella* which might belong to *C. rhomboides*, Smith, was taken off Tutaga in 50 - 60 fathoms.

ADDENDA.—Since revising the preceding pages, I have found among the shells which I collected at Funafuti, the following additional species :—*Engina lineata*, Reeve; *Sistrum dumosum*, Conrad; and *Sistrum undatum*, Chemnitz.

* Dall—Bull. Mus. Comp. Zool., xii., 1886, p. 237, pl. viii., fig. 7.

CONCLUDING REMARKS.

THE Collections gathered at Funafuti by Mr. Charles Hedley, on which the observations contained in the present volume are principally based, were supplemented by other gatherings made during the Second Expedition to that Atoll by Prof. T. W. E. David, B.A., and Mr. G. Sweet, of Melbourne, and whilst the Third Expedition was in progress by Messrs. A. E. Finckh and G. H. Halligan.

A selection of the specimens obtained by Prof. David and Messrs. Finckh and Halligan was presented to the Trustees by the Local Funafuti Committee of the Royal Society of London; Mr. Sweet very kindly lent his Mollusca for investigation, and presented duplicates of the otherwise unrepresented species to the Trustees; whilst, chiefly owing to Mr. Halligan's exertions, we are indebted for a knowledge of those forms of Molluscan life occurring in the Pteropod Ooze of Funafuti.

The larger portion of the descriptive work, fell, by far, to the lot of Messrs. C. Hedley and T. Whitelegge, the former contributing the General Account of the Atoll, the Ethnology and the Mollusca, whilst Mr. Whitelegge is responsible for the articles on the Crustacea, Echinodermata, Alcyonaria, Spongida, Madreporaria, Hydrozoa, Scyphozoa, and Vermes.

Mr. J. P. Hill has laid the Australian Museum under obligations by the readiness with which he collaborated with Mr. Whitelegge in working out the Actinozoa, and on his own account investigated the Enteropneusta.

Mr. W. J. Rainbow described the Insect and Arachnian Faunas; Mr. E. R. Waite the Mammals, Reptilia, and Pisces; whilst the few facts that could be gleaned respecting the Aves and Rocks, were recorded by Mr. A. J. North and Dr. T. Cooksey respectively.

A "Summary of the Fauna of Funafuti," prepared by Mr. Hedley, with the assistance of his colleagues, is given in Part 8 of the Memoir, including not only the results derived from their conjoint work, but also embodying the researches of other investigators that have appeared during the progress of the Memoir through the press.

Capt. E. C. Hore, of the London Missionary Society, and late of the s.s. "John Williams," prepared a very excellent model of the Atoll of Funafuti, which is deposited in the Australian Museum.

Memoir No. iii. of the Australian Museum Series comprises ten parts, commencing in December, 1896. The ninth, published in August, 1899, completed the descriptive matter, and the tenth or final part contains the Indices. The respective dates of publication of each part are given on the front coloured wrappers.

R. ETHERIDGE, JUNR.,
CURATOR.

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